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ARMATURE CORE TEETH

From a mechanical standpoint the T-shaped tooth on ironclad armatures has recognized advantages over the straight tooth. The projections on the former allow of tightly wedging the conductors in place by means of wooden strips or other material, thus obviating the use of binding wires, while at the same time affording better protection to the conductors. These advantages are, however, to a large extent offset by other disadvantages, both mechanical and electrical. In the case of direct-current machines, the armature conductors, which are almost entirely surrounded by iron, form coils of very high self-induction, thus having a tendency to produce excessive sparking unless some more or less effective precautions are taken. Of the several methods proposed for the elimination of sparking, the easiest to carry out is to increase the clearance, a method, however, which increases the reluctance so that the increased permeance as compared with the smooth-core type of armature which would otherwise be obtained is to a large extent lost, while a greater loss is incurred owing to the necessary increased magnetizing force. It is likely that the advent of the formed coil system, especially in the direct-current armature, is about to deal a death-blow to the T-shaped tooth. The ease with which these coils may be placed upon the armature the superior insulation that may be given to the winding and the greater facilities they offer for removal and repair, are advantages that more than counterbalance the use of binding wires. It can hardly be asserted that binding wires on large machines are really a disadvantage, since in repairing any drum armature, several coils must be removed, and the wedging of each otherwise necessitated greatly increases the labor, while the removal of the binding wires on a straight-toothed armature frees all coils at the same time. By turning grooves in the tops of the teeth, the binding wires do not increase the clearance, or materially increase the reluctance. Furthermore, in alternators, the moderate self-induction is preferable as they synchronize better when running as synchronizing motors or generators operating in parallel. In an induction motor, however, these arguments do not apply.

MUTUAL INDUCTANCE OF PARALLEL CIRCUITS.

Of the many problems arising in attaining a successful transmission of electrical energy over comparatively long distances that of eliminating the inductance effects is one which has been met and partially overcome by employing several methods differing in themselves with different systems. The use of condensers or the overexcitation of the fields of synchronous motors offers an effective means, but it is at the same time advisable to so arrange the line conductors that the mutual inductance is either eliminated or reduced to a minimum. In the communication which appears in other columns of this issue, Prof. Jackson adds another important contribution to the several treatments which have thus far appeared on the calculation of the inductance of transmission lines. Although treating of but four conductors the method employed may be readily extended so as to apply to either six or eight, which at the present time are the more practical conditions. It is the practical application of theoretical conclusions that interests the engineer, so that the best arrangement of his circuits may be obtained. This, as Prof. Jackson points out, is to keep the several conductors of the same circuit together, while the various circuits should be separated as far as possible. As has been previously shown, three-phase transmission conductors arranged in the form of a triangle practically eliminates all inductance effects, while for two-

phase transmission, the best method is to place the planes of each pair of conductors at right angles, at the same time maintaining the wires in a symmetrical position. In the case of two three-phase circuits employing six wires, the practice is to use two cross-arms, placing one circuit on each side of the pole, four wires being on the upper arm and two on the lower. Here, again, symmetry is to be observed. With a telephone circuit on the same poles practically all inductive action on the latter may be eliminated by spiraling the transmission conductors at regular intervals, at the same time transposing the telephone wires more frequently, the latter being done as often as each quarter of a mile. Care should also be taken to have the number of transpositions odd, so that the number of loops will be even. Prof. Jackson points out the serious effects which might be produced if alternating currents of different frequencies are transmitted over circuits located on the same poles, a practice, however, not likely to be often met with. Notwithstanding the accuracy with which the mutual induction of parallel power-distributing circuits may be calculated, it will scarcely warrant the trouble to calculate the effects between a power circuit and telephone circuit, but rather resort to experiment for the determination of the best conditions.

THE NEW YORK STATE STREET RAILWAY CONVENTION.

From the standpoint of the quality of the papers read before the New York State Street Railway Convention, held in Binghamton last week, the meeting may be regarded as having been successful. It is to be regretted, however, that this association does not differ from many others of like character in respect to discussions on the papers presented. A few inquisitive delegates can often bring out more valuable information than is contained in the papers themselves. A single paper represents the ideas, or experience, or both, of perhaps but one member, and if his opinions are accepted without debate it is apt to signify a dearth of ideas among the auditors. Papers of the kind presented at Binghamton would lose much of their force if distributed prior to the meeting, but it would seem possible that a brief digest might be given to the individual members prior to its presentation. In his address President Rogers touched upon some topics which are of the utmost importance to railway men and which might have received more attention at the hands of the meeting than their mere mention in this formal manner. It is still an open question as to the economy of direct-connected units for railway plants in the smaller cities. In large power stations direct-connected units are accomplishing excellent results, but it does not follow that a similar type in a smaller plant would make a proportionately good record for economy, and, in fact, experience and careful tests in several cases seem to prove that it is decidedly uneconomical to operate large units on a small road. The sentiment therefore seems to be rather against the practice. The anomalous position occupied by the City of New York in the matter of street railway transportation facilities was referred to by Mr. Rogers. To an outsider not familiar with the existing local conditions and limitations it seems inexplicable that the first city in the land should be so far behind the time in street railway matters. New York is certainly a city of curiosities in this respect, for which we have the considerate city fathers to thank. Another topic introduced was the transfer problem, which has been one of the most difficult that street railway men have been obliged to solve, and they are not yet agreed as to the best manner of treating it. Of course, the larger the road the more complex is its transfer system, and were it not for the inherent tendency of human nature to get something for nothing the problem would be considerably simplified. The companies, however, deserve much credit for what they have accomplished, especially as no law exists to compel them to give transfers, and yet they are as a rule the most earnest advocates of the system, the reason being that it induces the public to ride. Notwithstanding the fact that the discussions were of a meagre nature the meeting was the most successful and profitable of the four thus far held by the association.

IMPORTANT STREET RAILWAY QUESTIONS.

Several papers of considerable importance to railway men were presented before the Binghamton convention last week, a few of which will be found in other columns of this issue, while others will appear at a subsequent date. The problem of carrying out to the most effective and economical extent the daily inspection of cars is one aptly considered by Mr. Cahoon. As pointed out by him, the daily inspection of cars, at least on small roads, should be of such a thorough nature that troubles likely to develop during the course of the day's run may be detected and remedied in due time. A thorough overhauling at the end of each month restores the car to a condition favoring the most economical operation, and a plan therefore which no street railway manager will question, but only the extent to which it should be carried out. The rating of dynamo-electric machinery has thus far been done by various manufacturers in an absolutely arbitrary manner, with the result that machines rated at the same output not only differ widely in size, but attain various final temperatures after running at their rated capacity for several hours. It would certainly be to the advantage of the manufacturer, as well as to the street railway man, as Mr. Clark stated, to have a definite standard for comparison, such a standard to be determined and fixed by such representative bodies as the American Institute of Electrical Engineers, National Electric Light Association and the American Street Railway Association. Uniformity in rating would enable the purchaser to select a machine of a given output entirely upon its merits and for the particular conditions which it was desired to fulfill, while it would enable the manufacturer to compete on a fair basis and not subject him to the lower bids based upon the different rating employed by a competing firm. The effectiveness with which old rails may be employed as return feeders is fully demonstrated by the results obtained in Buffalo, where an estimated saving of $12,000 resulted from their use as compared with the cost of copper return feeders of equivalent capacity. Inasmuch as the question has been proposed at various times and almost as frequently ridiculed, the tests and results reported by Mr. Rusling offer a very conclusive argument in favor of their use. Another paper which is of great practical import and one leading to greater economy in operating roads is that of selling power by street railway companies. As stated by Mr. Newton, there is little foundation for the opinion and the adverse rulings of the fire underwriters to the use of 500 volt ground return circuits. The question is one which should be thoroughly agitated by street railway men, who, by doing so, will in the end gain their points. Each of the papers presented involves questions which are daily confronting managers of electric street railway systems, and therefore deserves careful consideration on the part of those who were not fortunate enough to attend the meeting.

Riding on the Front Platforms

A decision of considerable importance was rendered by the Appellate Division of the Supreme Court on Sept. 11. The case was that of George Hastings against the Central Cross-town Railroad of New York. Hastings was riding on one of the company's cars and was smoking. The conductor told him he would have to go to the front platform if he wished to smoke. Hastings complied. The conductor went to collect Hastings' fare who let go the hand rail to get the money from his pocket. As he did so the car struck a bad spot in the road, and he was thrown off and injured.

On the trial of the case the lower court agreed with the railway company that as there were seats inside the car, and Hastings, had he been in one of them would not have been injured, was guilty of contributory negligence, and the case was not submitted to the jury. It was on an appeal from this decision that the case came before the Appellate Division. The opinion on appeal is written by Justice Patterson. The decision of the lower court is reversed and a new trial ordered. Justice Ingraham dissented.

Mutual Induction of Parallel Distributing Circuits.

BY DUGALD C. JACKSON.

It is well understood that when two or more electric light or power circuits carrying alternating currents run parallel to each other they act inductively upon one another, and in some cases the mutual induction may cause considerable interference with the uniformity of the pressure on the lines; but the method of calculating the magnitude of the effects is not so well-known. Mr. C. F. Scott gave some examples of these magnitudes a couple of years ago,[1] but he did not outline the method of making the calculations. I therefore give the outline below, from which it will be seen that the mutual inductance of any two parallel circuits of indefinitely great length may be easily calculated, provided the distances apart of the different wires composing the circuits are known.

The number of lines of force which pass through or link with one circuit, due to one ampere flowing in the other, is numerically equal to 10^9 times the mutual inductance of the two circuits, and this number of lines of force is equal to the algebraic sum of the number of lines of force embraced by the first circuit which would be set up by the current in the individual conductors of the second circuit taken separately. The number of lines of force set up by one ampere in a conductor, which are embraced by an adjoining parallel circuit per centimetre of its length, may be easily proved to be equal to

$$N = \int_n^m \frac{2da}{a} = 2\log_\epsilon \frac{m}{n} = 4.60 \log_{10} \frac{m}{n};$$

where m and n are the distances of the independent conductor from the two conductors of the circuit, and the symbol $\log_\epsilon$ refers to Naperian logarithms, while $\log_{10}$ refers to common logarithms. This formula is based upon the assumption that the currents are concentrated at the centres of the wires, which is not absolutely correct, but introduces an insignificant error with the ordinary dimensions of conductors and circuits.

The following examples represent the commonest arrangements of circuits on pole lines. Suppose that a, a' and b, b' represent the conductors of two circuits, A and B, and that the order of the wires is $a - a' - b - b'$, the distance apart centre to centre of the wires of circuit A is x, of circuit B is y, and of the adjacent wires of the two circuits $(a' - b)$ is z; then if we consider the space between two planes perpendicular to the circuits and one centimetre apart, the number of lines of force due to a current of one ampere in a', which pass through the circuit B between the planes, is

$$N_{a'} = \int_z^{y+z} \frac{2\,da}{a} = 4.60 \log_{10} \frac{y+z}{z},$$

and the number of lines of force due to a current of one ampere in a, which pass through the circuit B between the planes, is

$$N_a = -\int_{x+z}^{x+y+z} \frac{2\,da}{a} = 4.60 \log_{10} \frac{x+y+z}{x+z}.$$

The total number of lines of force set up by the current of one ampere in circuit A, which pass through the circuit B between the planes, is $N_a + N_{a'}$, the number which link through the B circuit in length l is

$$l(N_a + N_{a'}),$$

and the mutual inductance of the parallel circuits of length l centimetres is

$$M = \frac{l(N_a + N_{a'})}{10^9} = \frac{4.60\,l}{10^9}\left(\log_{10}\frac{y+z}{z} - \log_{10}\frac{x+y+z}{x+z}\right)$$
$$= \frac{4.60\,l}{10^9}\log_{10}\frac{(x+z)(y+z)}{z(x+y+z)}.$$

If $x = y$, this becomes

$$M = \frac{4.60\,l}{10^9}\log_{10}\frac{(x+z)^2}{z(2x+z)};$$

and if $x = y = z$, it becomes

$$M = \frac{4.60\,l}{10^9}\log_{10}\frac{4}{3} = \frac{.575\,l}{10^9}$$

where l is the length of the parallel circuits in centimetres.

If the length of the parallel circuits is given in feet, the constant in the equations must be multiplied by 30.5, so that the mutual inductance per foot of the circuits becomes in the last case

$$\frac{17.5}{10^9}, \text{ and } M_f = \frac{17.5\,L}{10^9}$$

when L is the length of the parallel circuits in feet.

Exchanging the order of the wires so that the circuit A is between the conductors of circuit B, thus, $b - a - a' - b'$, changes the formulas. Here the algebraic sum of the number of lines of force set up by the circuit A, which link with circuit B, is equal to the total number of lines of force set up by circuit A minus the number passing backward through $b - a$ and $a' - b'$. Suppose $a - a'$ is equal to x and $b - a$ and $a' - b'$ are each equal to y, then the total number of lines of force set up by one ampere in a length of one centimetre of circuit A is

$$N_a = 9.20 \log_{10}\frac{x}{r},$$

and the number of lines due to circuit A, which pass between the planes through the space $a - b$, is

$$N_{ab} = 4.60\left(\log_{10}\frac{y}{r} - \log_{10}\frac{x+y}{x}\right) = 4.60\log_{10}\frac{xy}{r(x+y)},$$

and $M = \frac{l}{10^9}(N_a - 2N_{ab}) = \frac{9.20\,l}{10^9}\left(\log_{10}\frac{x}{r} - \log_{10}\frac{xy}{r(x+y)}\right)$

$$= \frac{9.20\,l}{10^9}\log_{10}\frac{x+y}{y}.$$

If $x = y$; $M = \frac{9.20\,l}{10^9}\log_{10} 2 = \frac{2.77\,l}{10^9}$; and $M_f = \frac{84.5\,l}{10^9}$.

If the circuits are not in the same plane, as, for instance, they are arranged thus,

$$a - a',$$
$$b - b',$$

and the distance $a - a'$ is x, the distance $b - b'$ is y, the distance $a' - b'$ is z, the distance $a' - b$ is w, $a - b$ is v, and $a - b'$ is u; then the formulas are

$$N_a = 4.60\left(\log_{10}\frac{u}{x} - \log_{10}\frac{v}{r}\right) = 4.60\log_{10}\frac{u}{v},$$

$$N_{a'} = 4.60\left(\log_{10}\frac{w}{r} - \log_{10}\frac{z}{r}\right) = 4.60\log_{10}\frac{w}{z},$$

and

$$M = \frac{l}{10^9}(N_a + N_{a'}) = \frac{4.60l}{10^9}\log_{10}\frac{uw}{vz}.$$

If one circuit is directly beneath the other, $x = y$, $v = z$, and $w = u = \sqrt{x^2 + z^2}$, and the formula becomes

$$M = \frac{4.60l}{10^9}\log_{10}\frac{x^2+z^2}{z^2}.$$

If $x = y = v = z$;

$$M = \frac{4.60l}{10^9}\log_{10} 2 = \frac{1.38l}{10^9}, \text{ and } M_f = \frac{42.2L}{10^9}.$$

These results show plainly that the mutual inductance of two circuits is entirely independent of the actual distances apart of the conductors composing the circuits, and depends wholly upon the relative values of the distances. The mutual inductance of two circuits is a maximum when the circuits are exactly superposed, and decreases as the distance between the circuits is increased in comparison with the distance apart of the conductors of each circuit; consequently, mutual inductance between circuits on the same pole line may be reduced by decreasing the distance between the conductors of each circuit and increasing the distance apart of the circuits. A better way to avoid mutual inductance in some cases is to transpose the position of the circuits with reference to each other, as is done in long-distance telephone lines, so that the inductive effects of the circuits on each other are in opposition in different parts of the line, and neutralize each other for the line as a whole.

The effect of mutual inductance between two circuits is to set up an electrical pressure in one when the current in the other varies. If the current is a sinusoidal alternating one this pressure is $2\pi f MC$ (where f is the frequency and C is the current in amperes), and the effect of an alternating current in one circuit upon another circuit is easily determined if M is known. The pressure induced in each circuit is in quadrature with the current in the inducing circuit, and when the two circuits are fed from the same alternator this induced pressure combines geometrically with the pressure supplied to the circuit by the alternator. In the case of two parallel circuits

[1] THE ELECTRICAL WORLD, Vol. 23, p. 393.

fed from a single-phase alternator, the resultant effect of mutual induction is to cause a drop of pressure along both lines; but the mutual induction between the different circuits of a polyphase system may cause either a drop, a rise, or no effect on the pressure, depending upon the phase relations and the positions of the wires.

If the two parallel circuits are fed from different alternators the frequency of which is slightly different, the inductive pressure and impressed pressure interfere so as to form pulsations or beats, the frequency of which is equal to the difference of the two alternator frequencies, and the amplitude of which is the sum of the two pressures. This may cause a perceptible winking of incandescent lamps connected to mutually-inductive circuits of nearly the same frequency.

Meeting of the American Electro-Therapeutic Association.

The sixth annual meeting of the American Electro-Therapeutic Association will be held in Allston Hall, The Studio Building, Clarendon Street, Boston, on Sept. 29 and 30 and Oct. 1, next. The programme is as follows:

SEPT. 29.—MORNING SESSION.

Papers.—What can be done by means of the use of electricity to avoid surgical operations, by Dr. G. Beeton Massey, Philadelphia, Pa.; Electricity in chronic non-suppurative affections of the uterine appendages, by Dr. F. Shavoir, Stamford, Conn.; Electricity in the treatment of diseases of the throat and nose, by Dr. O. B. Douglass, New York City; Electricity in the treatment of diseases of the larynx, by Dr. W. C. Phillips, New York City.

AFTERNOON SESSION.

Accidents and risks in the use of street currents. How far are they practicable and safe in the use of electro-therapeutics? By Mr. J. J. Carty, E. E., New York City.

Discussion by Mr. John J. Cabot, E. E., Cincinnati, O.

DIGEST.

Showing the danger to patients and operators, the utter unreliability of fuse wires, resistance coils and incandescent lamps as a preventive of excess flow of current into patient. The liability of and danger due to the crossing of operator's wire, by wires carrying high-tension current, both direct and alternating. Mr. John J. Cabot, E. E., Cincinnati, O.

Experiments upon the effects of direct electrization of the stomach, by Dr. Max Einhorn, New York City; Electricity in diseases of the stomach, by Dr. David D. Stewart, Philadelphia, Pa,; The static current in the post-apoplectic state, by Dr. John Gerin, Auburn, N. Y.

EVENING SESSION.

Lecture I. The electrical principles generally used in medical treatment, by Prof. William F. Puffer, Boston, Mass.

Lecture II. The relations of physics to physiology, by Prof. A. E. Dolbear, Tufts College, Mass.

SEPT. 30. - MORNING SESSION.

Electro-therapy in the treatment of the nervous, by W. S. Watson, Fishkill-on-Hudson, N. Y.; The role of electricity in the treatment of uric acid diathesis, by Dr. J. G. Davis, New York City; Some observations in electro-therapeutics, by Dr. D R. Brower, Chicago, Ill.; The physics of the production of the X-rays, by Dr. Edwin J. Houston, Mr. A E. Kennelly, Philadelphia, Pa.; Treatment of strictures by electrolysis *versus* any other treatment, by Dr. F. H. Wallace, Boston, Mass.; The Newman method of urethral electrolysis, its advantages and the reasons why some operators fail, by Dr. Francis B. Bishop, Washington, D. C.; Faradism in gynæcology, by Dr. R. J. Nunn, Savannah, Ga.

AFTERNOON SESSION.

Discussion. The Motor Dynamo—adapted to electro-therapeutic work. Dr. W. J Herdman, Ann Arbor, Mich.

Discussion by Mr. Edwin W. Hammer, E.E., New York City; Dr. G. J. Englemann, Boston, Mass.

The application of electricity to surgery, by Dr. W. J. Herdman, Ann Arbor, Mich.; Some experiences and experiments in the construction of high-tension coils and electrodes, by Dr. Frank W. Ross, A.M., Elmira, N. Y.; Electricity considered in its relation to gynæcology, by Dr. O. S. Phelps, New York City. On the electro-therapeutics of the constant current, by Mr. A. E. Kennelly, Philadelphia, Pa.

EVENING SESSION.

Executive Session.—Election of officers for ensuing year, 1897.

Reception to the members of the American Electro-Therapeutic Association and their friends by the medical profession of Boston, Mass.

On Oct. 1 a visit will be made to the electrical plant of Prof. Elihu Thomson, at Lynn, Mass.

Electric Lighting in Belfast, Ireland.

In the issue of The Electrical World, Aug. 29, was published the paper read by Mr. McCowen before the Institution of Mechanical Engineers at Belfast. The accompanying curves, for which we are indebted to the London *Electrical Engineer*, give the gas consumption, plotted from the results of tests on a tandem and on a single gas engine; they show the total consumption per hour, per indicated horse-power per hour, and per electrical horse-power-hour,

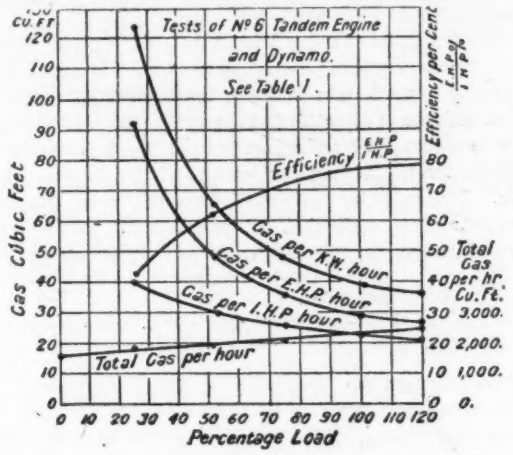


Fig. 1.

and also the percentage of efficiency or rates of electrical horse-power to indicated horse-power. The engine, of which the test, graphically recorded in Fig. 1, was made, is a double-cylinder double-acting one, with cylinders working tandem and the two pistons on the same rod. This is connected through a cross-head and connecting-rod to the crank. The bore of the back cylinders is 13.75 inches, and of the front, 13.5 inches; the stroke is 20 inches. The fly-wheel and driving-wheel, one fixed on each end of the crank-shaft, are each 8 feet 5 inches in diameter and weigh 37 cwt. and 29 cwt. respectively; the driving-wheel is grooved for eight ⅞-inch ropes. This engine runs at a speed of 160 revolutions per minute and indicates 120 horse-power;

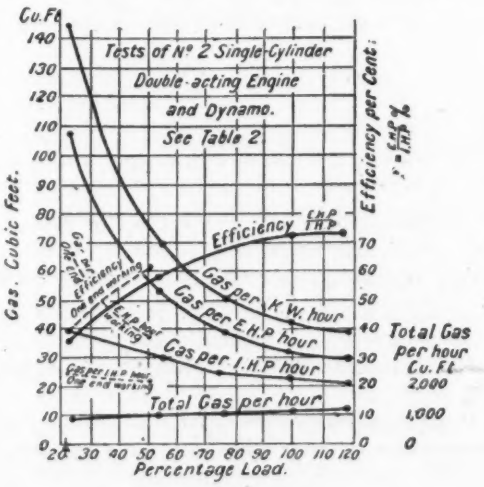


Fig. 2.

the number of explosions per minute is 320, or two per revolution. The smaller engine, to which Fig. 2 applies, is a single-cylinder, double-acting one; the cylinder is 13½ inches diameter and 20-inch stroke. It runs at 160 revolutions per minute, and indicates 60 horse-power. The number of explosions per minute is 160, or one per revolution. The fly-wheel and driving-wheel are each 7 feet diameter, and each weighs 57 cwt. The cyclical variation in the speed of the tandem engines is very small, owing to the number of explosions, their low initial pressure, and their even distribution, the number of explosions being as 4 to 1 in comparison with a single-cylinder, single-acting engine. The results shown in these curves were tabulated in the paper, but the graphical record is much easier for reference.

The Electric Installation of the Mohawk Building, Cleveland.

ANOTHER large office building in the City of Cleveland is that known as the Mohawk Building, adjoining the Public Square and situated directly opposite the Post Office. The architect, C. S. Swinefurth, engaged as engineers for the electrical and steam plant, the well-known firm of E. P. Roberts & Co., of Cleveland. The equipment, which was provided in accordance with their specifications, is in some features unique.

The steam equipment consists of three 60 x 16 horizontal tubular boilers, provided with a Murphy setting, manufactured by the Cleveland Boiler Works. They also have a Murphy mechanical stoker, with which, it will be remembered, the coal is fired into the reservoirs at the side of the boiler and then spread upon the fire by a mechanism driven by a small steam engine. The necessity of opening the furnace door is at times of cleaning only. Soft coal is used

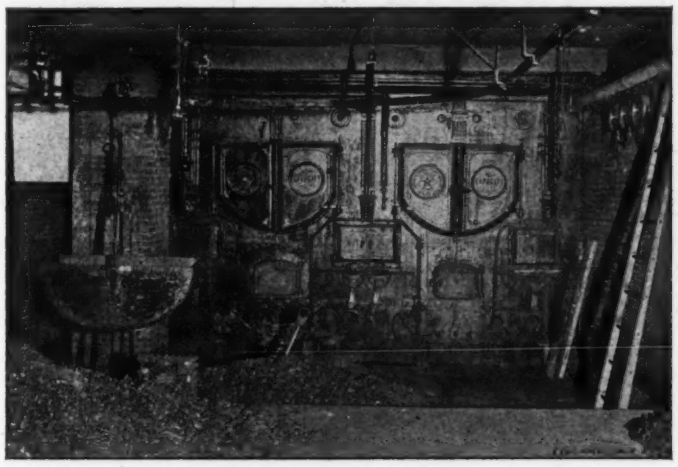


FIG. 1.—BOILER ROOM.

and Cleveland city feed water, which is fed to the boilers by Worthington steam pumps, with an injector in reserve. The coal is carried to the boilers by means of a hopper running on an overhead structure similar to the method frequently found in slaughter houses. A section of the rail is isolated and connected to a scale so that the hopper and its contents may be weighed. This system is shown in Fig. 1, which is an illustration of the boiler room, and at the same time the view of the boiler fronts shows the doors of the mechanical stokers and the arrangement of the customary indicating apparatus.

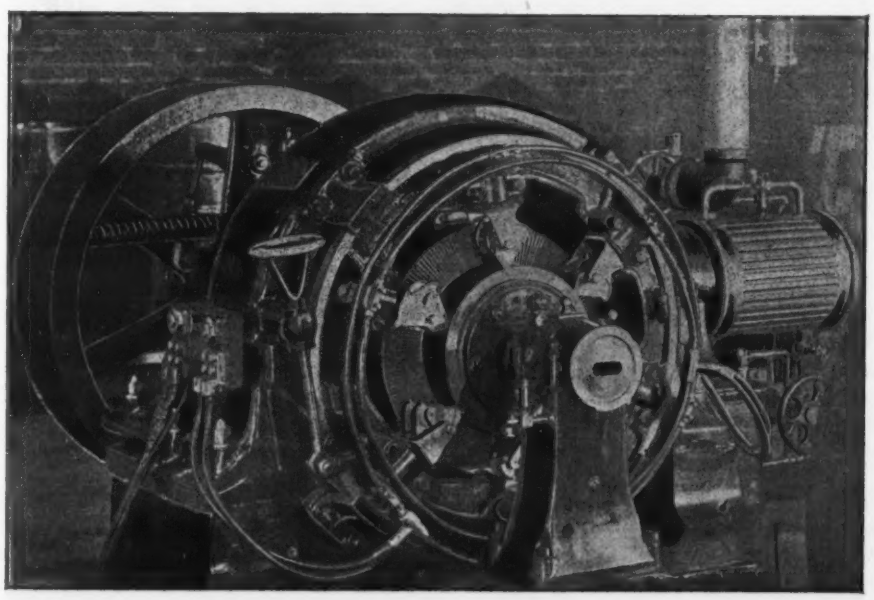


FIG. 2.—ENGINE AND DYNAMO.

The steam pipe system is single, magnesia covered, and provided with Chapman gate and Jenkins globe valves, the whole being installed by Chafer & Becker of Cleveland. Steam is delivered at 90 pounds pressure to the engines, passing through an Austin steam separator and grease extractor.

The three Ball engines, made by the Ball Engine Company, Erie, Pa., are exactly alike, run at 300 revolutions, and have cylinders each 10 x 12 inches. Each is direct-connected to a Walker 25-kw dynamo, capable of delivering 240 amperes at 115 volts.

These generating sets, one of which is shown in Fig. 2, are very compact. The Walker dynamo has a cast-iron field frame, wrought-iron laminated poles, ironclad armature, and uses the special brush-holder and brush-adjusting devices which are making the Walker

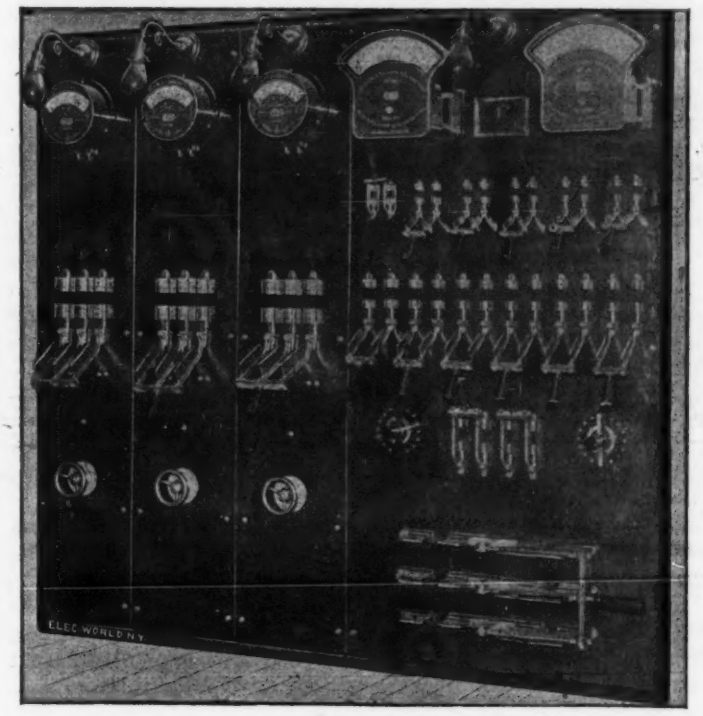


FIG. 3.—SWITCHBOARD.

machines deservedly popular. These brushes and holders run notably free of sparking and prevent the commutator from overheating by reason of the fact that all contacts are solidly bolted and therefore have ample conducting capacity. The springs of the brush-holder are so arranged that they do not transmit any current, and hence cannot overheat and lose temper. The dynamo is provided with an outboard bearing. These machines are of the six-pole type, and the armatures being lap-wound it is necessary to have six brushes. They run in multiple and are connected to the switchboard by three-pole switches on an equalizer system, the equalizer being on the middle jaws of the switch.

The switchboard shown in Fig. 3 is of the panel type. Each generator has its own panel and another panel is accorded to the circuits and general instruments. The machine panels consist of a rheostat at the base of the board, a three-pole switch and an ammeter of the round type pattern, the whole being illuminated by an incandescent lamp. The circuit board, as will be seen, carries a voltmeter and a differential galvanometer, and is provided with 14 circuits. Two little voltmeter switches manipulate the voltmeter and galvanometer, and at the base of the board is a large three-pole double-throw switch, by means of which the whole building can be thrown onto the local Edison mains. Between the ammeters is a little glass frame, where may be set a card on which are data giving the proper voltages at which to run the switchboard voltmeter in order to secure any desired drop at the sockets about the building, and also deflections of the differential galvanometer corresponding to various insulation resistances. The board is the design of Mr. E. P. Roberts, and was built by the W. D. Graves Electrical Manufacturing Company for the Walker Company. The exhaust fans for

the boiler room and for the kitchen of the restaurant were built by the Buffalo Forge Company, and are belt-driven by Elliott & Crawford motors. The wiring was done by L. K. Comstock Company, of Chicago.

The circuits pass from the switchboard to the risers on porcelain insulators and up the pipe shaft. In that part of the building they are protected by iron-armored interior conduit. All the wiring in the restaurant and on the first floor is on the iron-armored conduit system, with a few exceptions, where a small amount of brass-armored conduit is used. For the 11 office floors and the hall lights the wires are run in iron-armored conduit, while the office wires themselves are in moulding.

The building is wired on the cabinet system, each cabinet being recessed into the wall and lined with marble. The hall lights have five circuits on each floor, each controlled from a cabinet near the elevators. The chandelier near the elevators has two circuits, one of which is the all-night circuit, and controls only one light. The amount of wire in the building, all of which is simplex, is as follows: 1502 feet of No. 0, B. & S. gauge; 762 feet of No. 1, 858 feet of No. 2, 1390 feet of No. 4, 5718 feet of No. 6, 2412 feet of No. 10, 2480 feet of No. 12, and 29,880 feet of No. 14.

Electrical Waves in Long Parallel Wires.*

BY A. D. COLE.

The experimental study to be described in this paper was undertaken as a preliminary to a research on the refractive index of certain liquids for electrical undulations as deduced from a measurement of the ratio of the wave-length in the material under investigation to that in air. That research has been published in *Wiedemann's Annalen* (February, 1896) and in full abstract in the last number of the *Physical Review*, but so many facts not hitherto described were noted in the preliminary study that I have ventured to bring them before you in the present paper.

Stationary electrical waves were produced in two long wires according to the method of Hertz and Lecker by means of the apparatus shown in Fig. 1.

I is an induction coil capable of giving a spark several centimetres long. Wires from its secondary terminals are joined to the two primary plates *P P'*, the latter being connected together (except for a spark gap of 2 to 4 mm) by short rods terminated by brass balls.

The distance between the primary plates could be varied by sliding these rods in their support, and the resulting changes in the capacity and self-induction of the system controlled the oscillation period. The primary plates were 40 cm square and 3-10 cm apart.

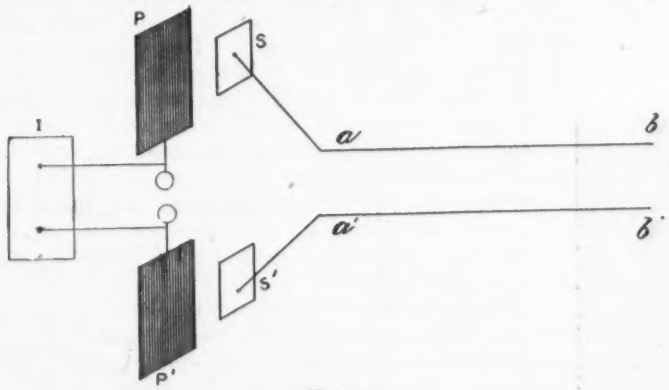


Fig. 1.

From the oscillations set up in them by the discharges of the induction coil, oscillations were induced in two secondary plates, each 10 cm square, placed a few centimetres in front of the primary plates. To the centre of each secondary plate a long wire was attached and these two wires, after approaching (as seen at *aa'*) to a distance of 8 cm apart, stretched away horizontal and parallel a distance of about 4 metres. At every oscillation of the secondary plates a wave of electricity passed along each wire, was reflected back at its end and produced by interference with new advancing waves, a system of stationary waves with alternating nodes and ventral segments analogous to the stationary sound-waves in a vibrating stretched string.

A short wire placed across the parallel wires in general caused the glow to cease, but a few positions could be found such that the tube placed across the ends of the wires still continued to glow. Three such positions could be found with the apparatus used. These were separated by equal intervals and marked nodal positions, any interval giving the half wave-length of the undulations in the wires. The ends of the wires and terminal plates form ventral segments in the resonance system. H. Rubens[1] had succeeded in measuring not only the length but the form and amplitude of such waves by use of the instrument devised by Paalzow and named the "dynamo-bolometer." I used the same instrument employed by Rubens in his study of stationary waves in wires. Fig. 2 shows its construction. R_1 R_2 R_3 R_4 are the resistances of a balanced Wheatstone bridge. Two of these, R_1 and R_3, are themselves balanced bridges, each of

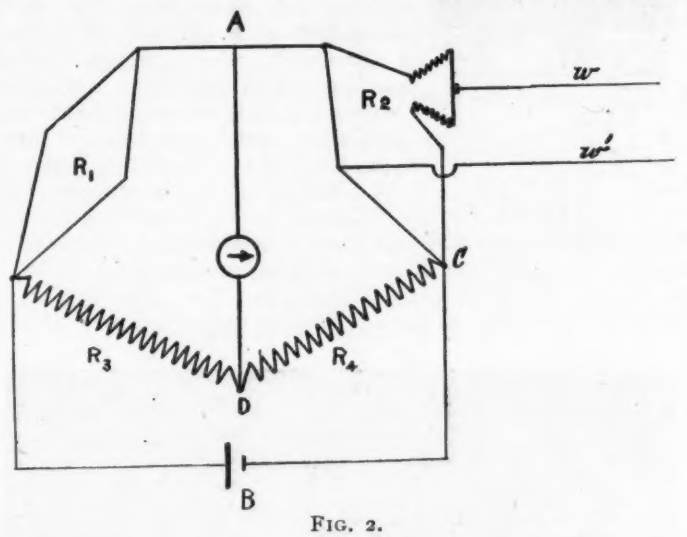


Fig. 2.

their four arms being a very fine iron wire about 10 cm long and of seven ohms resistance. Suppose the whole system balanced, and a weak but steady current supplied by the battery *B*. The galvanometer shows no deflections. Evidently if alternating currents such as produced by electrical oscillations enter by the wires *ww'* they will circulate only in the minor bridge R_2, but will disturb the balance of the main bridge by the heating effect in R_3. This disturbance, if not too great, will be proportioned to the heating effect producing it and this in turn, as the authors have shown, to the energy of the oscillations in the wires *ww'*. The galvanometer deflections become therefore a direct measure of the intensity of the electrical oscillations.[2]

To avoid disturbing the wave system in the wires, Rubens did not attach the wires *w w'* from the dynamo-bolometer directly to the points of the parallel wires to be investigated, but to little Leyden jars, made by placing around the wires bits of glass tube surrounded by shorter strips of metal foil as "outer coatings," the wires themselves forming the "inner coatings." With this apparatus, larger galvanometer deflections, obtained when the bridge wire is at a node, correspond to the glowing of the Geissler tube in Lecher's arrangement.

The wave distribution along the parallel wires was studied as follows: The Leyden jars were placed over the ends of the wires, a bridge of wire placed in a definite position across the wires as shown by a tape measure stretched below, current sent through the induction coil, and the galvanometer deflection produced by the heating of the dynamo-bolometer read. This was repeated three or four times for each bridge position, and bridge positions taken 5 to 10 cm apart over the whole length of the wire. Many such series of observations were made, the conditions being varied somewhat to learn the effect of such variation. The results may be best presented in the form of curves, abscissæ representing positions of the bridge on the wire and ordinates the means of four to six corresponding galvanometer deflections in millimetres.

Rubens had noted that the number of maxima in a curve is diminished by (*a*) increasing the distance between the primary plates, and (*b*) leaving a bridge at a maximum position and exploring with a second sliding bridge. These conclusions may be verified by comparing a number of my curves. Thus, in one case, there are six strong maxima and perhaps eight weaker ones. In this experiment the primary plates were 4.5 cm apart. By increasing this distance to 8 cm the three strong maxima, separated from one another by intervals of 146 cm, almost disappeared, the other three remaining.

Again, by leaving a bridge in the position corresponding to the maximum nearest the secondary plates and exploring with a second

* Abstract of paper read before A. A. A. S., Buffalo meeting.

[1] *Wied. Ann.*, 42, p. 154 (1891).

[2] *Wied. Ann.*, 37, p. 769 (1890).

bridge, all but three of the 15 maxima practically disappeared. These three occupied positions 8, 154.5 and 303.5 cm, at practically equal distances apart. The middle one was especially strong and sharp, the other two weaker but about equally strong. The effect of a fixed bridge is thus to reduce a somewhat complicated wave system to a simple one.

The maxima obtained were so improved in both strength and sharpness by the use of a second bridge that two very careful determinations of their position were made to get an idea of the degree of precision allowed by this method of calculating the half wave-length.

First time, maxima at	25.3	188.5	351.4	Intervals, 163.2	162.9
Second time, maxima at	24.8	188.4	351.5	Intervals, 163.6	163.1

At any one time the nodal positions seemed to be capable of being located within a fourth of a centimetre, and on repeating the experiment the same results could be expected within a half centimetre.

Still greater steadiness and definiteness was secured in some later experiments by the use of three or even four fixed bridges.

No change has been attributed to a change of the distance between primary and secondary plates by other experiments so far as I am aware; but a comparison of several of my curves seems to indicate quite clearly that diminishing this distance increases the complexity of the curve.

As it was my plan to estimate the refractive index of a number of liquids by surrounding a portion of two parallel stretched wires, by the liquid under investigation, it seemed desirable to use the wires much nearer together than other experimenters or I myself had done before, in order to avoid the necessity of using a larger amount of liquid than I could readily obtain. I accordingly set up my apparatus again, with the wires only three cm apart. By this change two distinct results were produced. In the first place, the deflections produced corresponding to the maxima positions on the wire were considerably reduced in amount, viz.: to about one third of the value before obtained. This was easily provided for. As the galvanometer used had been adjusted to only moderate sensitiveness, a new adjustment of it gave deflections sufficiently large. The other changes noticed by bringing the wires nearer was a shortening of the interval between nodal positions. To make sure of this result and to measure the amount of the change, three complete determinations of the three maxima were made, readings being made at each centimetre on the wire near the maxima positions. The results are as follows:

			Means.	Difference	Previous.
26.6	26.7	26.5	26.6		
187.5	187.5	187.5	187.5	160.9	163.4
347.4	347.7	347.5	347.5	160.0	163.0

The three determinations agree so well that there can be little doubt of a shortening of the internodal interval by about 3 cm or 1.5 per cent. But the true change is more than this, for the bridges

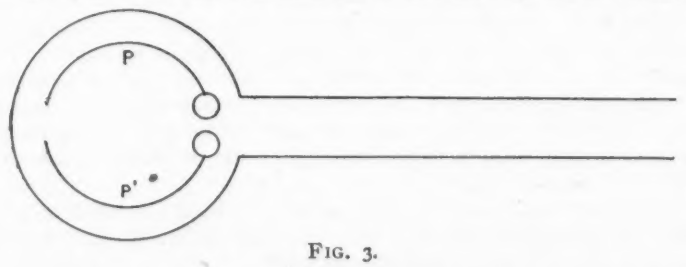


FIG. 3.

themselves form a part of the resonance system, and two thirds of their length should be added to the apparent internodal distance to get the true half wave-length. The bridges were 12 cm long in the first instance, and 3 in the second.

This correction gives 171.5 as the half wave-length for wires 8 cm apart, and 162.5 for wires 3 cm apart, a change of 9 cm or more than 5 per cent.

It became desirable next to study the effect of surrounding a portion of the parallel wires by a containing vessel such as would be suitable for holding a liquid. A covered trough of zinc, 100 cm by 10 x 10 inches with the wires passing centrally through the ends through rubber stoppers, was used, one end being made to coincide with the centre maximum.

The internodal spaces, which had been equal before, were now different, that which included the metal box being shortened 3.3 cm or about 2 per cent.

The result is of the sort that we would expect, as the proximity of the metal box would naturally increase the capacity of a given length of the wires in that neighborhood, rendering a shorter length necessary.

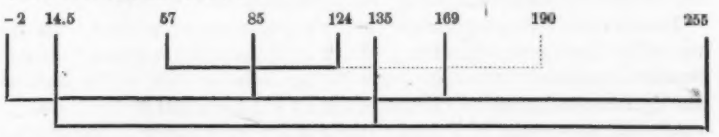
Later experiments, in which there were two internodal spaces before the box was reached, developed the fact that the influence of the box upon the half wave external, but adjacent to it, was considerable, since this half wave was invariably 5 cm shorter than the one more remote from the box.

When the box was filled with distilled water only a small constant deflection of the galvanometer was obtained, and this was shown to be due partly to a direct magnetic effect of the induction coil upon the galvanometer and partly to current induced in the bolometer wires from the wires connecting the induction coil and storage battery.

Up to this time the little Leyden jars had always been placed at the remote end of the parallel wires. The jars were now removed, and still smaller ones of the same sort placed at the ventral segments of the two external half waves. Although these had very small outer coatings—consisting of cylinders of copper foil 5 mm in diameter and 5 mm long—it was found that their capacity could not be neglected, but was equal to 2.5 cm wire-length. Still smaller jars were next made of a single turn of very fine wire about a glass tube 5 mm in diameter. This was found to make no appreciable change in the position of the maxima, and still, when placed at a ventral segment and connected to the dynamo-bolometer, large deflections (100 mm) were obtained.

Very fine resonance systems were obtained in the external portion of the parallel wires in those experiments where a node was forced at the box end and better than had been obtained with the parallel wires alone. This result is not attributed to the presence of the box, but rather to the use of the Leyden jars at intermediate ventral segments and to the readjustment of bridges already placed when the capacity of the system was changed by adding a new bridge.

Thus in one experiment with bridge fixed at box end 255 nodes were located as follows:



Notice nodes at 14.5, 135 and 255 show intervals 120 and 120.5; mean 120.3 x 2½ = 501.
" —2, 85, 169, 255 " " 86, 84, 87; mean 85.7 x 3½ = 500.
" 57, 124 67; x 4½ = 501.5.

i. e., according as the nodal position occupied belonged to group 1, 2 or 3, the vibrating system consisted of 2½, 3½ or 4½, half waves.

These results gave a simple means of calculating the equivalent of the secondary plates and the wires connecting to the parallel wires in terms of the equivalent length of parallel wires. As the parallel wires began at — 7 of the scale the first node (— 2) is 5 cm from one end of the parallel wires, but the whole part of the system beyond this node $= \frac{86}{2}$ or 43 minus 5 = 38 as the equivalent in cm of the parallel wires for the capacity of the end plate 6 × 6 cm and the 11 cm of wire leading from it to the parallel wires.

From another system of nodes we get in the same way the same result. Thus:

$\frac{120}{2}$ = 60 minus (7+14.5) = 38.5 or practically the same as before.

From another experiment with a system of very different length of parallel wires, the wire equivalent of the same plates come out 39 2 and 40; mean, 39.6.

The distribution of energy in the internodal spaces was next investigated. Bridges were placed at two nodal positions external to the box and the Leyden jars moved from one end of the intervening half wave to the other at intervals of 10 cm. In each position four readings of the galvanometer were made, the mean values taken as ordinates for a curve whose abscissas were bridge positions, gave directly the distribution of electrical energy in the wires. For positions between successive nodes a very smooth and regular curve was obtained, which differs but little from a sine curve.

When a bridge was placed at the box end, to force a node there, filling the box with distilled water left the wave system in the air-surrounded portion of the wires unchanged, but only slight and unsatisfactory traces of a wave system could be detected within or beyond the box, whether by Leyden jars placed at the end, or by those placed on the wires within the liquid. Of course the introduction of liquid, by the change in capacity, might be expected to destroy the resonance within and beyond the box, but it was hoped that by careful adjustment of a variable capacity at the ends, the total capacity of

this part of the system might be increased exactly to some simple multiple of its former value and resonance restored. These hopes proved delusive. The capacity at the end was gradually varied by different means through wide limits, but any such change seemed to make no difference whatever in the resonance conditions within. This attempt was then given up, and special attention paid to attaining (*a*) great galvanometer sensitiveness, (*b*) great purity in the semi-conducting liquids used, (*c*) using vessels that the liquid would have no action upon glass and silvered glass, and (*d*) taking very short intervals along the wire between successive series of readings. Kohn had used this method already to determine the refractive index of water. By the use of all these precautions well defined maxima were finally obtained, both with water and alcohol. The maxima, however, were less sharp, and far weaker in the portion of the wire surrounded by liquid than in that surrounded by air. As, however, the half wave-length is considerably less in the liquid (only one ninth as much in water as in air) it was possible to obtain as many as four maxima even within a vessel 78 cm long. The details of this portion of the work are described in the recent paper in *Wiedemann's Annalin* to which reference has already been made.

Recently I have been making experiments with the Blondlot exciter of electrical oscillations, which, according to a recent paper by Drude, is better suited for developing oscillations in long parallel wires than the Lecher form which I used before. In this there are no pairs of primary and secondary plates, but the inner ends of the parallel wires are joined by a circularly curved wire shown in Fig. 3. Within and separated from this circular wire by only a small distance is a pair of primary exciters, PP', bent so as to form arcs of a circle concentric with the surrounding wire, and carrying brass balls for a spark gap at the inner ends. These exciters are connected to the secondary terminals of an induction coil.

I have also followed Drude in using a strip of mirror with its metallic film cut across with a sharp knife or diamond point, as described by Righi, as a substitute for the Geissler tube of Lecher, or the dynamo-bolometer of Rubens, but as yet have not by their means made any important additions to the results obtained with the earlier apparatus.

Launch of Mr. Astor's Electric Yacht.

The electric yacht of Mr. John Jacob Astor was launched at Upper Nyack, N. Y., on the afternoon of Sept. 10. The craft was christened *Utopian* by Miss Elizabeth M. Jewett.

The *Utopian* is said to be the largest electric yacht in the world. She is 72 feet long over all, 12 feet beam, and has a draught of 3 feet 6 inches. Electric power from 480 cells of storage battery will propel the boat at a calculated speed of 16 miles an hour. The twin-screws will be driven by 25-hp electric motors. Among other electrical features will be a powerful searchlight. The batteries will be charged at Mr. Astor's electric light plant at Rhinecliff, and will be capable of maintaining a continuous run of 12 hours.

The yacht is fitted throughout with electric lights, electric bells, etc., and electricity is utilized in every way possible to promote comfort and convenience.

Patent Office Report.

Hon. John S. Seymour, Commissioner of Patents, has submitted his report to the Secretary of the Interior on the business of the Patent Office for the fiscal year ended June 30, 1896. It shows that 48,105 applications and caveats were received, 24,585 patents were granted and 15,580 patents withheld and patents expired. The receipts from all sources during the year were $1,307,090; expenditures $1,097,368, leaving a surplus of $209,721. The number of applications awaiting action is 8943.

On the Seat of Electro-Dynamic Force in Ironclad Armatures.

In the article under the above heading, which appeared in The Electrical World of Sept. 5, page 271, the sentence commencing on the ninth line should read: "It is further known that projecting teeth do not increase the torque except in so far as they increase the flux through the air gap."

Corrections.

In the editorial on Compressed Air Traction, which appeared in The Electrical World, Sept. 12, read "cities" for "critics," on the 17th line.

On page 306 Fig. 3 should be Fig. 4, and Fig. 4 should be Fig. 6.

Convention of the Street Railway Association of the State of New York.

THE fourth annual meeting of the Street Railway Association of New York was held at the Bennett House, Binghamton, N. Y., on Sept. 8 last.

The meeting was called to order at 10.30 a. m. by President G. Tracy Rogers, and after the disposition of some routine work he read an address, in the course of which he referred to the general healthy condition of street railway interests in the State. The past year was not marked by any startling or radical changes in the street railway world. The most important advance, perhaps, was the universal adoption of large plants of direct-connected generators, over 80 per cent. of the machines produced during the year being of this class. It still remains a question, however, whether the adoption of direct-connected units is true economy in smaller cities and towns, where the total demand for power is not great, real estate comparatively cheap and operation of the road variable, necessitating the use of several small units.

The experience of the past year has demonstrated that where very long lines of street railways are to be operated, power can be economically delivered 20 miles or more from the power-station by the three-phase system and the use of high-tension current. The experience of the past year has also demonstrated that with direct current machines, longer lines than we had previously supposed can, by the addition boosters, be operated economically.

President Rogers briefly referred to the success of the third rail system on the Nantasket Beach line and on the Chicago elevated road, and to the subway now building in Boston and the great advantages that would result to the traveling public by its use. He showed up in strong light the antiquated and inadequate street transportation facilities in New York City. This condition of things, however, he said, is not a reflection on the enterprise of the railroad interests of that city, but upon the municipality, because of the restrictions put upon the railroad people by the authorities.

Touching the carrying of United States mails, express and freight on suburban and interurban lines, he stated his belief that express and freight were more profitable than mail. He then quoted from the Railroad Commissioners' report for 1895, showing the cost of operation of street railways in the State, as compared with their income, which roads he said afforded the cheapest transportation in the world.

Regarding the subject of fenders, Mr. Rogers stated as the opinion of many street railway men that the fender is a menace. The best fender for the front end of a car, he thought, is a clear-headed motorman.

No question is of greater importance to the street railway companies and the manufacturers of equipment and electrical apparatus, than that of having some definite standard as regards the rating of motors and generators, and as regards the features involved in application of the same, such as diameter of car axles, wheels, height of car body from track, etc. The practice of steam roads affecting these points, he thought, could be profitably adopted by electrical interests.

In conclusion, President Rogers referred to the method of producing electricity direct from coal, invented by Dr. W. W. Jacques, which, he thought, was full of promise.

The report of the Executive Committee was then presented, from which is taken the following:

Never before in the history of the association has there been such a large number of measures introduced in both branches of the Legislature in a single year pertaining to the organization, operation and maintenance of street railways. Heretofore street railway measures introduced in both branches of the Legislature to a large extent were so unimportant and even ridiculous in their test and construction that they were not worthy of even passing notice. However, the majority of bills introduced the past year were important in character, and would, had they become laws, have seriously affected the physical and financial operation of street railroads throughout the State.

The report of the treasurer was next read and accepted.

Mr. J. H. Stedman, of Rochester, read a report on "The Matter of Transfers," from which the following extracts are made:

"A liberal transfer system, properly guarded to prevent fraud, pays. This is, I think, now generally recognized. Local conditions and arrangements of lines must be considered in determining the regulations to be adopted. The rules intended to safeguard the

company are important. Perhaps equally important is the making of rules broad enough to encourage riding.

"We must, of course, protect ourselves against the abuses of the tickets by the passengers and against the frauds of the conductors. The passenger can be held in check by short time limit and specific conditions.

"Whether it is better to ring up transfers is a subject which has provoked much discussion. To ring them up does, of course, give them at once a cash value; but not to ring them paralyzes the spotter or detective, and the latter I think is generally admitted to be of greater importance. No detective can properly check up a car unless the conductor of that car is compelled by the company's rules to take up cash, transfer ticket or pass coupon from every passenger and to ring the register for every passenger. The weight of opinion seems now to be to ring up transfers, and preferably on a separate register. Nothing is absolutely a safeguard except the transfer method itself. With a protective transfer guarded by the coincidence of time and consecutive number in sequence of issue, honesty may be secured."

In the discussion which ensued, Mr. Rossiter, of the Brooklyn Heights road, inquired if any one of the delegates would express an opinion as to whether bicycles are seriously hurting the revenues of the different roads, and also how they could ascertain whether the the transfers increase cash receipts. "We carried 2,600,000 passengers on free transfers last month," he said, "and increased our earnings about $40,000. The other roads in the city which publish their reports monthly report a decrease, but there are a number of reasons why we should increase. We give a transfer to a passenger who is riding on a transfer. We have considered this question carefully and believe the percentage is, comparatively speaking, very small where passengers take a second transfer; and if you eliminate certain lines where we do not run our cars direct to the Bridge or ferries or some other point, I doubt if 2 per cent. of the passengers having a transfer take a second one."

Mr. Deming: In Buffalo we have more or less trouble with the people abusing the transfer system, and it is hard to devise means to stop it. It is a matter which must be left to the intelligence of the conductor in a great degree; but I do not think there is a very large part of the public that endeavor to beat the transfer system. We find more trouble with them on a pleasant Sunday afternoon, when they are riding around for pleasure, than any other time. Our system is laid out in such shape that it is possible to ride all day long on a transfer. [Laughter.] I have been studying a new form of transfer, which may put a stop to it.

Mr. Robinson: A great deal of difficulty arises in New York from the use of transfer tickets. There are some lines on which persons can get five or six transfers. For instance, go down Lexington avenue to Thirty-fourth street, and transfer to Broadway or Sixth avenue, ride to Twenty-third street and get a transfer west on Twenty-third street to Seventh, Eighth or Ninth avenues, and ride back to Fifty-ninth street, and get a transfer back on Fifty-ninth street to Lexington avenue, and continue riding all day, if desired. We also have difficulty at the points where we have transfer agents and the tickets are punched. The passengers give the tickets to boys, and the boys sell them or they put them in places where other people can get them. Once in a while a case of conscience turns up. On several occasions we have received refunds of 5-cent pieces, evidently from people who used this means of transferring.

The President: I think the general adoption of the transfer system is an indication that the street railways are anxious to serve their patrons. There is no law compelling us to give the transfers, but the roads have done it, and they have found that in accommodating the public they have increased their revenues.

The paper of C. Loomis Allen, of Syracuse, on "General Track Construction, and the Most Approved Method," was then read.

In the discussion President Rogers said: There is no question that the heavy rail of the height we are all using has been found to be the best. I do not know that there are many roads adopting the high carbon standard.

The next topic was the paper by Mr. W. W. Cole, of Elmira: "How Can We Prevent Accident and Increase the General Efficiency of Employees?"

President Rogers called upon Mr. Robinson to explain the system of instruction in vogue on the Metropolitan Street Railway lines.

Mr. Robinson: The Metropolitan Street Railway Company organized a club, the chief object of which was to educate the motormen and conductors and hold meetings, to which all other operatives of the company are invited. During the last season, ending the 1st of May, there were a series of lectures held every two or three weeks. We had competent lecturers, the lectures being illustrated with appropriate stereopticon views, and the subject of underground trolley, cable machinery, cable apparatus, in fact, the general operations of the road, were made plain by means of the photographic views. I think individual instruction is preferable to that received at the lectures, but the lectures are entertaining, and they have been largely attended by the working classes. On the whole, they are considered very advantageous, and it is proposed to continue, and in fact, enlarge them during the coming Winter. We depend entirely on the instructors at the present time to turn the men over to the superintendents competent to run the motors, and the superintendent is supposed to instruct them in regard to the details of each division, grade crossings, stops to be made at certain streets, etc. We furnish our men with rooms where they can secure papers, etc., and we have gone into the instruction and examination of the men closer than we ever did it before, with very beneficial results. I think the men take more interest in their work, and we are having less accidents, which shows an improvement in the class of men we are securing.

The methods of instruction on the Erie Railroad and on the Delaware & Hudson Canal Company's line were described by Messrs. Fitch and C. D. Hammond, respectively.

Mr. H. S. Newton then read a paper entitled "Power from the Trolley Circuit. Is It Practicable? Why Do the Fire Insurance Companies Object? What Should Be Done to Overcome the Objections?" This paper was followed by one on "The Daily Inspection and Care of Car Equipments," by James B. Cahoon.

In the discussion Mr. Cole stated that he objected to the motormen or conductors making any special inspection; it soils the clothing in a short time, and the men will wear a poorer class of clothing, and you have an ill-dressed lot of men. It is unpleasant for the passenger to have a conductor with dirty hands to collect fares, which he will be sure to have if he must clean his car at the end of the trip.

A paper was then read by Mr. H. S. Cooper, of Schenectady, on "The Desirability of Forming a Board of Claim Agents."

The meeting then took a recess.

At the afternoon session the first business was the reading of a paper by Mr. F. O. Rusling, of Rochester, on "The Use of Old Rails as Underground Conductors."

There being no discussion on this paper, the meeting proceeded to consider the next paper, entitled "Railway Power Stations," by Mr. Thomas Henning, of Buffalo, N. Y.

Mr. W. J. Clark, of New York, upon invitation of the president, contributed a paper on the general subject of electrical development; after which Mr. H. A. Robinson then gave some notes on the management of accident cases as practiced by the Metropolitan Street Railway Company.

The Nominating Committee was appointed, and subsequently reported, and the following officers were elected for the ensuing year:

President, G. Tracy Rogers, Binghamton, N. Y.; first vice-president, W. Caryl Ely, Niagara Falls, N. Y.; second vice-president, John N. Beckley, Rochester, N. Y. Executive Committee: H. H. Vreeland, New York, N. Y.; John W. McNamara, Albany, N. Y.; Henry M. Watson, Buffalo, N. Y.; C. L. Rossiter, Brooklyn, N. Y. Secretary and treasurer, H. A. Robinson, New York, N. Y.

The meeting then adjourned to meet at Niagara Falls the second Tuesday in September, 1897, and the delegates started for a trolley ride to Ross Park, State Hospital, and other local points of interest, terminating with a 10-mile ride to Union. Luncheon was served at the Casino.

At the banquet in the evening, the following toasts were responded to: "City of Binghamton," George E. Green, Mayor. "Our Hosts, the Binghamton Railroad Company," W. W. Cole. "Our Lady Riders," Joseph M. Johnson. "Our Pro and Con Friends—the Lawyers," Hon. Edmund O'Connor. "Our Dearest Foe and Our Warmest Ally—the Press," Col. Sam. Payne. "Our Friends Who Keep Us Guessing—the Legislature," Hon. C. F. Tupper. "Children of a Larger Growth—the Steam Railroads," Mr. C. D. Hammond.

J. H. Stedman, of Rochester, acted as toastmaster.

THE ATTENDANCE.

Following is a list of delegates of street railway companies who attended the convention:

Allen, C. Loomis, Syracuse.
Clark, J. P. E., Binghamton.
Cole, W. W., Elmira.
Cooper, H. S., Schenectady.
Danforth, R. E., Buffalo.
Deming, P. C., Buffalo.

Evans, H. C., Brooklyn.
Frick, Benj., Whitestone.
Gould, Frank, Oneonta.
Haven, Wm. E., Fishkill.
Johnson, J. M., Binghamton.
Hallock, F. M., Elmira.
Hallock, H. H., Elmira.
Lamfield, J. B., Binghamton.
Maloney, F. J., Elmira.
Moffitt, John H., Syracuse.
Mooney, F. P., Cortland.
McCormack, Ira, Brooklyn.
McKeever, R. T., Gloversville.
O'Connor, Edmund, Binghamton.
Rehn, George T., Hornellsville.
Robinson, H. A., New York.
Rogers, G. Tracy, Binghamton.
Rogers, John B., Binghamton.
Rossiter, C. L., Brooklyn.
Rusling, F. O., Rochester.
Seixas, E. F., Amsterdam.
Sliney, George H., Brooklyn.
Stedmann, J. H., Rochester.
Story, C. B., Hoosick Falls.
Van Etten, Amos, Kingston.
Williams, Timothy S., Brooklyn.
Younglove, James I., Johnstown.

Representatives of other interests:

Allison, Giles S., St. Louis Register Co., New York; Beran, T., General Electric Co., New York; Billings, William R., Taunton Locomotive Mfg. Co., Taunton; Blake, H. W., *Street Railway Journal*, New York; Boyd, J. Coleman, New Haven Fare Register Co., New Haven; Brady, Paul T., Westinghouse Electric & Mfg. Co., Syracuse; Brown, Harold P., New York; Bruckel, F. W., Johnson Co., New York; Calhoun, W. S., Brussels Tapestry Co., New York; Clark, W. J., General Electric Co., New York; Cockey, Marston R., John A. Roebling's Sons Co., New York; Cockroft, C. A., Chenango Engineering Co., Binghamton; Crossman, T. E., stenographer, Brooklyn; Crowell, H. H., General Electric Co., Syracuse; Davis, Isaac N., Binghamton; Doolittle, A B., Binghamton; Dunning, E. A., A. O. Schoonmaker, New York; Dutton, W. A., Dorner & Dutton, Cleveland; Evans, H. C., Johnson Co., New York; Field, Arthur W., Peckham Motor, Truck & Wheel Co., Boston; Fitch, C. R., New York; Flanders, C. Y., Morris Tasker & Co., Philadelphia; Frenyear, T. C., Westinghouse Electric & Mfg. Co., Buffalo; Granger, J. A., New York Car Wheel Works, New York; Hawes, W. C., Stow Mfg. Co., Binghamton; Hammond, C. R., Albany; Haskell, G. M., J. G. Brill Co., Philadelphia; Hotchkiss, C. F., Stow Mfg. Co., Binghamton; Hurley, Thomas A., Holmes, Booth & Hayden, New York; Jackson, Newton, Electric Mutual Casualty Insurance Ass'n, Scranton; Johnson, F. O., Stow Mfg. Co., Binghamton; Jones, J. G., Hazelton Boiler Co., Chicago; Kenfield, Fred. S., *Street Railway Review*, Chicago; Lawless, E. J., American Car Co.; St. Louis.; Maguire, J. F., Elmira; Mailloux, H. Jules, *The Car*, Philadelphia; Meek, S Glenn, H. W. Johns Co., New York; Mercur, R. J., N. Y. Car Wheel Works, Buffalo; Miner, Willard M., Bi-Metallic Electric Transmission Co., New York; Nicholson, S. L., Cutter Electric Mfg. Co., Philadelphia; Packer, E., Drummond Detective Agency, New York; Parker, L. H., General Electric Co., Schenectady; Pratt, Mason D., Pennsylvania Co., Steelton; Pugh, John S., John Stephenson Co., New York; Ransom, H. N., Consolidated Car Heating Co., Albany; Russell, F. D., Rochester Car Wheel Co., Rochester; Seely, John A., Belden & Seely, New York; Sjoberg, Wm., New York; Sweet, D. C., Springfield; Taylor, John, Taylor Electric Truck Co., Troy; Taylor, W. H, *Street Railway Journal*, New York; Vosburgh, A. C., New Process Raw Hide Co., Syracuse: Wallace, J. E., Smith & Wallace, Boston; Washburne, W. A., Cambria Iron Co, New York; Wharton, W. W., Mutual Casualty Insurance Ass'n, Scranton; Woodworth, A. C., Jr., Consolidated Car Fender Co., Providence; Zinn, D. E., Ramsey Signal System, Allegheny.

Power from the Trolley Circuit. Is it Practicable? Why Do the Fire Insurance Companies Object? What Should Be Done to Overcome the Objections? *

BY H. S. NEWTON.

An experience of several years in the erection and operation of power-stations has led me to the conclusion that the chief point of interest connected with them in the eyes of the management is the relative size of their coal bills. Witness the appearance and universal adoption in our modern stations of the compound-condensing engine, built in the Corliss and other most economical types where the non-condensing slide-valve was good enough a few years ago, and you see the effect, not of a desire to appropriate the results of engineering progress and thus be in fashion, but of an effort merely to bring about a reduction in the number of cars ordered from the coal dealer.

In many sections of the country the saving of a ton of coal per day is equivalent to the interest on $20,000. If a device costing, say $15,000 to install and operate, will accomplish this saving, it is clearly to the advantage of the street railway manager to install this device. And as a consequence of the realization of this fact, the railway power-station is to-day a combination of all that is economical in steam construction.

To a marine engineer, or to an engineer accustomed to the steady load encountered on shipboard, a glance at our engine rooms, when they are running under average conditions of service, must naturally, however, be surprising. He must, if he is a man of an inquiring disposition, feel some anxiety to find out why often half the available horse-power of the station is not in use, but instead is lying idle, a monument to several hundred thousand dollars in capital expended in its erection. The explanation that the several engines and dynamos are held in reserve for extra demands of traffic may satisfy him in the engineering sense, but cannot fail to call up questions as to the financial wisdom of such a condition of affairs.

* Paper read before the New York State Street Railway Convention.

To the electric railway manager who is striving with all his ability to bring operating expenses down to the limit which is prescribed by the best practice, any plan looking to the utilization at all times of at least a portion of this idle machinery and to the knocking off of a percentage of his power-account, must, naturally, appeal strongly. If such a plan does not involve further expenditures for extra apparatus, it appeals still more strongly, and, if practicable, may be adopted.

In some cities in other States the best plan for accomplishing this result has been found to be the sale of surplus power outside, or the supplying of current for manufacturers from the trolley circuit. In our own State, the adoption of this plan has been attended with so many difficulties, and has been subject to so many provisions at the hands of the insurance people, that I believe it is only in rare instances that it has been tried at all, and then only at the solicitation of the customer.

It has been recognized as a possible and highly practicable source of income by railway men generally, but a systematic move has never been made to compel the insurance companies to modify their rule covering the case, with the consequence that the rule still remains and our surpluses of power are still undisposed of.

It is my intention to first point out to this convention the chief advantages possessed by our railway systems as producers of power for private consumption, and then to follow with a statement of the objections raised by the Board of Fire Underwriters and others toward its adoption throughout the cities of New York State. Hitherto the electric light station has figured as the chief factor in the production of power for stationary motors. It is too often hampered though by circumstances of small units and insufficient reserve to consent to take hold on a large scale of a business necessarily offering what is, compared with that accruing from lighting, a reduced margin of profit. In lighting stations, too, employing large engines driving many machines, the variation in load always attendant on the use of motors is also objectionable from the fact that the lights are affected to some extent. In these particulars the railway station is prepared. The compound-condensing Corliss engines which are showing themselves in all our power-stations, are run at an economy of coal consumption which converts what would seem a very poor price for power into a figure containing a neat margin of profit.

Take for example a station in one of our cities, containing a 1200-hp direct-coupled Corliss engine held in reserve and estimate what could be done with the engine and its attached generator were it thrown into active duty on a private consumer's power circuit. Figure on an investment of $75,000 in the engine, generator and other apparatus relating to the two. Then assuming coal to be worth $3 a ton, and the engine to have a fuel duty of 3 pounds per horse-power per hour, we have coal consumed for each day of 10 hours: 18 tons at $3, $54.00; cost of labor, engineer, fireman and oiler, say, $10.00; oil and waste. $2.00; incidental repairs, $10.00, $76.00. Add to this 10 per cent. depreciation for one day, $20.55; interest on the investment at 5 per cent., $10.27; total, $106.82.

Then figuring on an ability to sell the output for 10 hours in the day at 2¾ cents per 1000 watt-hours, we have 1200 horse-power for 10 hours, equals 8,952,000 watt-hours at 2¾ cents, equals $246.18.

With cost of production as stated above, the net profit amounts to $139.36, a very fair sum to go toward reducing operating expenses.

I think it has been abundantly demonstrated in the past that long lines of shafting for mill work are the cause of an enormous waste of energy, and on that account alone, I am sure that there are numbers of the smaller mills in our cities which would save money if they rented their power at a reasonable rate from a railway company. The recording wattmeter has been brought to a high state of perfection, and by its aid there is no necessity for the consumer to pay for one iota of current more than he uses. Then he can divide up his factory among several smaller motors, can run one or all of them, as occasion may demand. This, too, with an outlay which should be inconsiderable compared with that the electric light companies would be compelled to charge were the power obtained from their circuits.

This plan would be feasible not only for shops using the very smallest of units, but it might be just as profitably considered by manufacturers using at present 50 or 100 horse-power steam plants and employing their own engineers. At 2¾ cents per 1000 watt-hours, were there 50 horse-power used uninterruptedly during the day, the charge would be a little over $10, while the presumption is

that were a small engine and boiler used to move line shafting for the same shop, the inferior economy of the steam plant, plus the increased power necessitated by loss in friction, would more than over-balance in cost the bill sent in by the railway company.

The small outlay required by the railway company in reaching consumers is another point to be urged in favor of supplying power from the trolley circuit. It is a noticeable fact that street railway engineers are providing much more liberally for their trolley feeders to-day than they did on the introduction of electricity as a motive power, and in consequence our lines are so well fed that the abstraction of a small percentage of power for outside use would hardly be noticed in the running of the cars. Then the close proximity of the feed wires on the railway circuits and the short taps and small expense required to connect them to factories would be a strong card in the eyes of the consumer.

The objections as advanced by the Board of Fire Underwriters to the use of trolley circuit for stationary motors seem to be embraced in one feature, the ground return.

The insurance man will relate to you long tales of the disastrous effects produced where the experiment has been tried, will suggest to you that you build a fire-proof house outside your building to hold your motor and run your machinery inside by means of a belt and line shaft (the very thing you do not wish to do) and will conclude by assuring you that if you will install a motor on the plan proposed, he will have to increase your rate by 2 per cent. on the face of your policy. This, he claims, is because a reliable method of insulating has not been discovered to make the installation a good risk.

Over in Syracuse we are using for supporting our various lines some 400 or 500 iron poles. Every pair of poles is to the trolley wire suspended between them a dead ground, and yet in the last three years, during which time I have held my position on the street railways there, we have never had one ground on these poles. And yet these insurance men tell us that they cannot find an insulation secure enough to warrant their insuring a building into which the trolley circuit runs, with every precaution taken for most careful insulation, without an addition to the premium such as I have noted. It is true, undoubtedly, that results speak, especially in the insurance business, and there is little reason to doubt that a great many disastrous fires have been started by the defective installation of electric light and power plants. It does not necessarily follow, however, that because a large percentage of these fires resulted from the contact of a current-carrying wire with a gas or water pipe, that a system of electrical transmission, between one of the wires of which, and the same gas or water pipe, no difference of potential exists by design should be barred out. Ninety per cent. of the arc light circuits in our cities, if subjected to the gas-pipe test, will show as great a capacity for kindling conflagrations as the much abused trolley circuit, and yet the arc circuits with their 3000 to 5000 volt difference of potential and their invariably grounded circuits come into all our buildings. With protected wiring and reliable insulators for holding the wires, both systems may be rendered absolutely safe, except as against criminal carelessness or evil design.

Some Hints on Railway Practice.*

BY W. J. CLARK.

We all know that in street railway operation there is not the necessity for the full and constant study of standardizing rolling stock that is being carried on by the master car builders and master mechanics of the steam roads, for in their case the continuous interchange of cars between various lines has necessitated an almost universal standard of draw-bars, couplers, etc., and a close approach to a standard in car body construction. With you this interchange of rolling stock only exists to a slight extent, these, of course, under such conditions that it makes no particular difference what the height of a car body is, the length of its wheel base, the style of its trucks, or what any other of its mechanical details are.

It is also true that the conditions and service of no two electric railways are alike, and that the necessities of one road as to character of car body, style of truck, type of motors, kind and size of engines and generators may be entirely different from the road next to it. So from the steam road standpoint standardization would be impossible, but in the practical operation of a street railway, different conditions exist from those met with in operation of a steam road, so you must view the special features of your business from a different standpoint than they. Unquestionably it would operate to your advantage, as it would most certainly to the electrical manufacturer, if some definite positive rule for the rating of all of the electrical apparatus were fixed. It makes but little difference what this basis of rating is, provided it is universal, well understood and thoroughly insisted upon by street railway men.

No one can suffer from such an arrangement, which is entirely just to both the manufacturer and user; and with the adoption of such a rule the little remaining mystery concerning the practical side of electrical apparatus would disappear, as it should do.

The electrical manufacturer, while justly entitled to much credit for the advancement of the science and the making of electrical railroading practical, has many sins to answer for under this heading of mystery, and the only power on earth which can absolve him from his remaining sins of this description is the united action of the users of his product to define distinctly and clearly what his product shall be called. And it makes no difference to him whether some particular article of his production is called a horse or an elephant, providing his competitor's production which should do the same work, is similarly designated. But if he uses the term horse and his competitor that of elephant, he is of course at a great disadvantage, while the purchaser who may not be thoroughly conversant with the different terms as applied may supposedly buy the larger animal, and when too late, discover that he has secured only a moderate sized pony.

The manufacturer who has used the larger term is not altogether to blame either, for no class of machinery has ever yet been produced which was susceptible to so many different methods of rating as electrical apparatus, and all of which may be considered honest, all such methods being entirely dependent upon the standpoint from which its producer views the matter—as, for instance, one producer may say, I will rate a certain sized generator so that it will give a product of 300 kilowatts continuously, and never rise to a dangerous limit of heating, so he calls this a 300-kw machine. Now this very machine would, for instance, develop say 400-kw capacity for a period of two hours without rising to a dangerous degree; so some other manufacturer says that in practical operation no generator ever had a continuous load up to its rated capacity; so a safe basis to go on is to rate the machine at what it will do for two hours, and he calls it a 400-kw machine. The natural sequence is that some one buys a machine that is either larger or smaller than what they supposed they were purchasing, and if they are fortunate enough to escape paying more money than they should for a certain capacity machine, they are exceedingly liable to get tangled up on the proper sized engine unit to go with the machine, and following in the wake of the transaction is the old story of engines being found too large or too small for the generators which they are coupled with. For this trouble our brethren of the engine trade are not by any means guiltless; for, as some of you have learned by experience, methods of engine rating are about as flexible as those followed on generators; and I trust that I will not be accused of giving away state secrets when I say that instances have come within my observation where the engine man and electrical agent have stood in together to make it appear to some prospective purchaser that he was getting at least all that he paid for in both engine and dynamo capacity. These evils have of course not troubled the larger roads, with their skilled engineers, so much as they have the smaller roads and the newer ones which were about to begin business; yet, it is unquestionably wise and just that all opportunities for mistakes, misunderstandings and misrepresentation on such features should be forever done away with.

What has been said on generator rating applies with equal or even greater force to the rating of street-car motors; for even greater differences exist in defining their capacity than is met with in generator practice. In fact, the varying features necessitated by the construction of motors for various characters of service renders greater opportunity for mystery than in connection with stationary machines, and the best of engineers are occasionally imposed upon by misused terms in connection with some particular class of motor, consequently some definite rule is even more necessary for their rating.

For both generators and motors it is imperative that there be some prescribed rule as regards the character and method of their insulation. In natural sequence to the question of motors comes that of car wiring. It is customary with all the manufacturers of car equipment to furnish a liberal quantity of good material for this purpose, and as to a great extent the work of installing the same is

* Abstract of paper read before the New York State Street Railway Convention.

done by the railway companies themselves, troubles from this source are not nearly so numerous as formerly; yet there are cases where installation is done by manufacturing companies, car builders and outside contractors, which would never pass inspection were the wiring done in any building of our larger cities. While the necessities for good work in this particular are of course far more apparent on a car body that is subjected to all sorts of movements and motions than in connection with the wiring of a building, the need of preparing for the last class of wiring was apparent years ago and has been strictly followed ever since, so no argument is needed for the fixing of standard car wiring rules.

On standardizing switches, circuit-breakers, bus-bars, etc., I can offer no better argument than to state that your engineers well know carrying capacity of certain weights of copper on their line of work, and on the articles which I have mentioned the results should be as well known and established as any other feature in the transmission of current.

In conclusion, a word should be said on the important feature of protection against lightning. No detail of electric railway equipment costs so little, and upon which so much is dependent, as upon its lightning arresters. Defects in this particular may cause many thousands of dollars' damage within an instant, so this question cannot be too carefully scanned and considered by your associations, and some standard fixed upon which will effectually protect your machinery.

On every feature of the business, the manufacturers will gladly conform to your actions and requests, and to sum up the whole situation in a nutshell, they exist for your benefit, not you for theirs, and that they now look to you for suggestions instead of making them to you.

The Daily Inspection and Care of Car Equipments.*

BY JAMES B. CAHOON.

In carrying out a system of daily inspection, or any system for the care of car equipments, we have in view a two-fold object.

First: To prevent breakdowns when the car is out on the road, and the consequent annoyance to passengers, as well as the blocking of traffic and the throwing of the cars off their schedule time.

Second: The reduction to a minimum of the repairs necessary to maintain the equipments in good working order and the prolongation of their life. We have, then, to determine how we can best accomplish these objects, and in so doing obtain the best results with the least expense.

Considering for a moment what we have to deal with, we find in the ordinary electrical car that we have two motors of 15 horse-power or upward, with their various connections, placed in the very worst possible position in which to operate machinery in motion, with occasional sticks, stones, wires, etc., thrown into them, and on rainy days and in the Wintertime to the throw of mud, slush and water from the wheels, and subjected to wide fluctuations in the power which they must produce under these unfavorable conditions. If we were to suggest to a steam engineer the placing of a fine engine to do work under similar conditions and in a similar situation, the chances are that he would say that it was not only impossible, but absurd to think of an engine, working satisfactorily under such circumstances, yet in many respects the electric motor is quite similar to the steam engine, as both have moving parts to be cleaned and properly lubricated, the motor having as its driving agent in the place of steam an electric current under comparatively high pressure, requiring certain parts to be carefully insulated or rupture would occur which would disable the motor for the time being. In fact, a careful comparison between the two, part for part, would show that the motor is the more delicate of the two machines, and should, therefore, in order to secure successful operation, have more careful attention paid to it, and be subjected to a systematic course of inspection of all its parts from time to time.

In general there are three systems in vogue at the present time, the first being to let the motors take care of themselves until something gives out, and then it is replaced and such repairs made as seem necessary at that time. Second, and the one followed by many of the smaller roads, is, when the car comes in at night, to have one or more men examine the boxes to see that they are filled with grease, rub off the commutator, and see that the brushes are not too far gone for the next day's use, and, if they are, to replace them with new ones, examine the trolley wheel and see that it is in good shape, and see that the brakes are repaired properly, then the car is washed or wiped on the outside and is ready for the next day's run. Following this, whenever a breakdown occurs, the car is run over the pit and given a thorough overhauling. The brasses, pinions and gears are examined and replaced if deemed necessary, and the motor is painted if it so requires and put into fair shape, or in some cases, it is taken down entirely and thoroughly overhauled.

The third system consists of a rigid daily inspection of the motors, trucks and car bodies, in all their parts, everything being gone over by competent inspectors, and the car not allowed to go out if any defects exist. This last system seems to be the only one by which we can hope to get perfectly satisfactory results, but it can be elaborated so that the expense would be more than the gain, though as a rule I have not found this to be the case. The system whose adoption I would advocate is that which we have put in practice on our road, and suggested to some other roads, which, from actual experience, has shown itself to be an eminently satisfactory one. This system is as follows: A trip inspection, a daily inspection and a monthly inspection. The trip inspection may be made in one of two ways; if the car runs into the car-barns at the end of each trip, it may be gone over by inspectors ready to receive it, who examine the boxes, see that there are no signs of heating, that the grease cups are properly filled, that the armature and fields are all right and that the brake mechanism is in proper condition. On small roads, where cars are not run into the car-barns, perhaps until the end of the day, this inspection can be made by the motorman at the end of each trip, it being a brief one and can be made in a couple of minutes, and if anything is out of order, the trouble can be remedied on the spot To this end as well as to any repairs *en route*, each car should be provided with a tool bag containing a small ball pein hammer, a 10-inch monkey wrench, pair of 8-inch pliers and 10-inch screw-driver.

The Daily Inspection.—When cars are run into the car-barns after the day's work is over, two inspectors board each car and go around armatures and fields as far as possible with a hand-bellows, wiping commutator, removing brushes and seeing that they are in good order and the copper peeled back on them so they will not wear into the copper coating during the next day's run, thus avoiding the squeak which this would cause. Every electrical connection is carefully examined to see that it has not become jarred loose, and if any defect exists in any part it is immediately repaired, if such repair will not involve over 10 minutes' work ; if it does, then the car is left over for the machinists to put in order on the following day. The same care is exercised in going carefully over all the nuts, bolts and washers, cotter pins, etc., connected with both motor and truck ; brake rods are gone over and brake shoes examined and everything seen to be in proper working condition for the morrow. The car is then turned over to the car washer, who goes over the outside of the car, cleaning all parts carefully, the inside of the car being swept out by the conductor who brings the car in, and the conductor who takes the car out in the morning cleans the brass work and windows and dusts off the seats and the inside of the car. In this manner we have caught a great many troubles just commencing, which cost comparatively little to fix at that stage, but which, if allowed to continue, would have entailed quite serious outlay.

Monthly Inspection.—Once a month in rotation each car is run over the pit and motors dropped down, taken apart and thoroughly cleaned ; gears, pinions and brasses, if they are so far worn that they will not last another month, are replaced. The armatures and fields are carefully cleaned and painted, and the commutator turned down if necessary ; in fact, the equipment is put into first-class order throughout, so that to all intents and purposes it is as good as new when again replaced on the car. The car-body and truck receive the same care and attention, and are also put into first-class running condition.

We have found by experience that a shoe having sections of harder material cast in it has effected quite a reduction in the cost of brake shoes, the average life of these shoes being about three and a half times that of the ordinary cast-iron shoe ; these shoes lasting a little over two months on our road, while the old style cast-iron shoe only lasted about 18 days.

A comparison of figures on our own road of the two different plans of the careful system of inspection and the old way of letting things go until they go to pieces, shows that the saving effected more than equals the total wages of the men employed on inspection and the machinists employed in the daytime repairing the cars. This, however, would not hold true on a large road, probably, but certainly the saving effected would considerably more than off-set the wages of the men on inspection alone, and I believe that a system such as outlined above will, if carefully followed out, accomplish the best results with the least expense.

* Paper read before the New York State Street Railway Convention.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS.

DYNAMOS, MOTORS AND TRANSFORMERS.

The Best Proportions of Transformers. PICOU. *L'Ind. Elec.*, Aug. 25.—A short correspondence referring to the recent article of Scattergood (see *Digest*, June 30), in which it was shown that the best efficiency is obtained when the dissipation of energy by the Joule effect is equal to that by hysteresis. The present writer states that he pointed out this relation as early as 1892; in this, the Joule effects should not only include those in the transformer but also those in the leads; it would not be correct, however, to conclude from this that modern transformers, in which the Joule effect is always much less than that due to hysteresis, are badly proportioned; there is another requirement, namely, self-regulation, which should be considered first.

Three-Phase Motors with Low Speed. GEORGES. *El'ty*, Sept. 9.—A translation of the paper abstracted in the *Digest* last week.

LIGHTS AND LIGHTING.

A Direct Current in an Alternating Arc. GOLD. *Zeit. f. Elek.*, July 15.—A reprint of a paper describing experiments made to further investigate the phenomenon noticed by Sahulka (see *Digest*, Dec. 1 and 15, 1894), namely, that a strong continuous current flows in the direction from iron to carbon in an alternating arc between two such electrodes; the original researches were made with the magnetic needle, which is not free from errors, as an alternating current has an effect on it; an alternating current has no effect only on specially hardened steel magnets; the ordinary needles used in galvanometers are strongly deflected by an alternating current depending on the original direction of the needle; the present writer therefore used a copper voltameter in order to show the existence of a continuous current. The electrodes were vertical, the carbon being the upper one; when the alternating current was 5, 6, and 7 amperes the continuous current was 3.2, 4.05 and 4.75 respectively; similar results were obtained when the electrodes were reversed in position or when they were horizontal; Sahulka's results are therefore confirmed. He then endeavors to find an explanation of the cause of the phenomenon, and gives some of the results of many hundreds of observations; he found that with the continuous currents the length of the arc for the same current strength and voltage is considerably less when the current flows from the iron to the carbon than in the reverse direction; immediately after extinguishing the arc a counter E. M. F. which generated the continuous current could not be found to exist; the continuous-current may be explained by the greater conductivity of the arc in the direction from the iron to the carbon after a current has flowed in the opposite direction and in the oscillations of the liquid iron electrode.

Consumption of Energy in Incandescent Lamps. PERSONALI. Lond. *Elec. Rev.*, Aug. 28.—A translation in abstract from the Italian, giving the results of some measurements with incandescent lamps and a comparison with similar results obtained by others, all of which show that there is a continuous slight decrease of power for the lamps in the course of their life.

Electric Light in Mining Operations. BAXTER. *West. Elec.*, Sept. 12.—A reprint of the article noticed in the *Digest*, July 18.

The Light of the Future. HOSPITALIER. *Prog. Age*, Sept. 1.—A translation of the article abstracted in the *Digest*, Aug. 8.

POWER AND HEAT.

Transmission of Power in Mines. KENNEDY. Lond. *Elec. Rev.*, Aug. 28; a continuation of his serial (see *Digest*, Aug. 29).—He continues the comparison of electricity and compressed air, showing that the efficiency with the former is 71 per cent. and with the latter 70 per cent. provided reheating is resorted to; the machinery for compressed air will be much more expensive and more complicated; in fiery mines, where reheating of the air is prohibited, the efficiency will be only 50 per cent.; the pipes would cost eight times more for first cost and maintenance, power for power, than the electric cables in a non-fiery mine and four times more in a fiery one; the amount of heat required for reheating is generally furnished by a coke stove, 15 pounds of coke per hour being sufficient to reheat the air for an 80-hp engine; it may also be reheated by burning petroleum in the compressed air itself.

Use of Electricity on Board Ships. EICKENRADT. Lond. *Elec.*, Aug. 28; a reprint of the paper noticed in the *Digest*, Aug. 1.—The only operation which he is disinclined to entrust to the electric motor is that of working the starting gear; he thinks that alternating currents will have to be employed for power purposes in order to avoid dangerous interferences with the compasses.

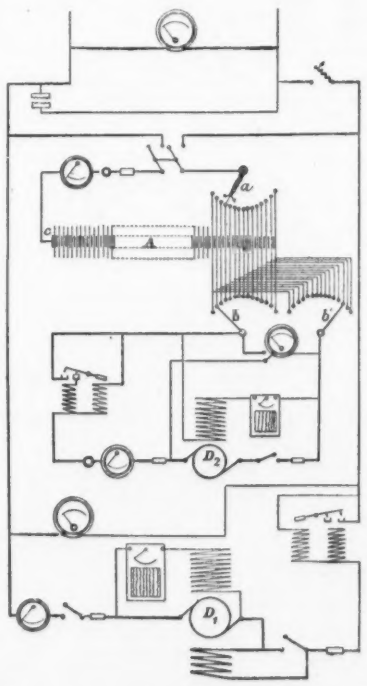
Cox Thermo-Electric Generator. Elec. Eng., Sept. 9.—A brief description of the works in England and the method of manufacture. The characteristic of this thermopile is that the oxidation at the joint, with the attending increase in resistance in the course of time, is avoided by having practically no real joint, the alloys being gradually shaded from one to the other; the oxidation of the joint is claimed to have been the main difficulty heretofore encountered in thermopiles. For one element he uses an alloy of antimony and zinc, and for the other an alloy of copper and nickel, each couple giving 0.08 volt; the alloying of the metals is obtained by casting them in steel moulds, which are brought to a high temperature and kept there for a considerable time, thus allowing a gradual process of alloying to take place. An element having an output of 5 amperes and 2.5 volts on closed circuit consumes 2.5 cubic feet of illuminating gas per hour; with oil a still better result is said to have been noted.

Thermo-Electric Generator. Cox system. *Elec. Rev.*, Sept. 9; a reprint of the recent article from the Lond. *Elec. Rev.*—Descriptions of these generators were published in American journals over a year ago.

Future of Power Development. STRONG. *West. Elec.*, Sept. 12.—A reprint of the paper noticed in the *Digest*, Aug. 15.

TRACTION.

Swiss Railways. Lond. *Engineering*, Aug. 28.—Brief descriptions of some of the electric railways in the neighborhood of Geneva, visited by the recent congress. The Lausanne railway is run by two gas generators of 130 horse-power each, using mixed gases, which are claimed to be superior to the Dowson gas. For the Zurichberg road Dowson gas is used in connection with a battery of 300 Tudor accumulators; the accompanying diagram shows all the connections, but the description, which



is as follows, is unfortunately very brief: "There is an automatic regulator *a b*, and further a hand regulator b^1 for the 90 control cells divided into 30 groups of three each. The cells are in parallel with the dynamo D_1. As represented on the diagram, the cells between *a* and *c* would be charged, while the cells beyond *a* would not receive any current if it were not for the auxiliary dynamo D_2, whose field coils are placed between *b* and b_1. The excitation of this dynamo changes with the number of cells in circuit. The interruptors are solenoids with mercury cups." The Vevey railway, in which accumulators are also used for compensation, is briefly described; the overhead conductors are slotted tubes.

Resistance of Cast Welded Rail Joints. MCCULLOCH. *St. Ry. Jour.*, September.—A brief description of some of the recent tests made on the 13 miles of welded track in St. Louis, which was laid about a year ago.

the tests were made by passing a strong current through the joint and measuring the fall in voltage and then carrying out the same tests with an equivalent length of rail; the resistance of the different joints was quite uniform, averaging 0.0000172 ohm; for the seven-inch rail he obtained 0.0000102 ohm per foot of rail; the joint covers 14 inches of rail and the resistance of a cast iron joint is therefore 44 per cent. greater than that of the same length of rail. To compare this with the resistance of bonded joints, a number of rails were bonded with some of the ordinary bonds in use, and the resistance measured, deducting therefrom the resistance of the copper wire; the lowest contact resistance obtained in this way was 0.00004 ohm, which is 2.5 times the total resistance of the cast joint. An attempt was made to measure the resistance of 1500 feet of track in the ground; the current was passed through the rails and the drop of voltage measured by a copper potential wire strung on poles; the calculation is not completed but it is stated that the resistance will be fully as low as that of the rails themselves, each track containing 85 cast welded joints.

Long-Distance and Heavy-Duty Electric Railways. Darlington. *Elec. Eng.*, Sept. 9.—A reprint of a paper read before the Pennsylvania Street Railway Association; it is general in character, calls attention to a few of the points involved, accompanied by some brief personal views, but no data. He refers to roads where electricity is to replace steam both for high speed and heavy freight. There is no longer any doubt as to the ability of the motors to do the work at reduced expense, but he believes the main question is how to transmit the electricity from the stationary engine to the motor; he believes the inability to prove without a doubt that the power can be transmitted satisfactorily over long distances is where the failure lies, and this is the one point to be worked out and demonstrated before there will be any general adoption of electricity for long-distance roads; he thinks the ideal system is a modification of the induction system in which there is no actual current-carrying contact; he thinks there will be a great change in five years; he believes that most of the electric railways in that State are paying too much money for their power, few are paying dividends and many are in the hands of receivers, when it should be possible to make them all pay; he favors the car-mile unit and the keeping of proper records; he advocates the appointment of a committee to gather data for the members of that association; he discusses grades, curves and trucks.

Comparison of Series-Parallel Controllers. Foster. *St. Ry. Jour.*, September.—The results of some tests made to determine the relative economy of different notches of series-parallel controllers; tables are given showing the variations in speed and power absorbed, the savings which may be obtained with different notches, etc.

Street Railway System of Hanover. Mailloux. *St. Ry. Jour.*, September.—A brief description of these lines on which a combined trolley and accumulator system is used, the accumulators remaining on the cars and being charged from the trolley line.

Power Distribution for Electric Railway. Bell. *St. Ry. Jour.*, September; a continuation of his long serial.—He discusses special methods of distribution, including the three-wire system, long-distance distribution, boosters, etc.

Railways on the Northern Coast of New Jersey. St. Ry. Jour., September.—An article describing two recently built lines connecting seaside resorts.

Growth of Electric Railways in Southern New England. St. Ry. Jour., September.—Some brief statistics and a map of Massachusetts, Rhode Island and Connecticut, showing each electric railway.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Alternating and Continuous-Current Dynamos at Woolwich. Moffett. Lond. *Elec.*, Aug. 28.—The object of this machine is to secure the elasticity of output for an alternating dynamo which is possessed by a direct-current machine when running in paralled with storage batteries; the machines (which are not illustrated) have been running for some years and consist of two sets of four-pole field magnets placed side by side on the same bed and two armatures, one for alternating and the other for continuous currents, both keyed on to the same shaft. The special switchboard arrangements which are required are described and illustrated; they provide also for synchronizing; all the speed regulation is done at the switchboard. With this arrangement it is possible to always run the engine at full load; if the alternating current required is greater than that which the engine can generate, the continuous end of the machine begins to act as a motor; the dynamos are driven by engines of 20 horse-power; the alternator is thus capable of dealing with a much greater load than the engine alone could, thus taking care of the peak of the load diagram; it is also very convenient in case of a sudden fog; also in case the belt should break or the engine have to be stopped; the regulation of the E. M. F. is said to be almost perfectly automatic; the alternating part can act as a synchronous motor while the continuous half sends current through the cells; in case the steam pressure drops this combination may also run as a motor generator taking energy from the batteries.

Central-Station Extensions. Addenbrooke. Lond. *Elec. Rev.*, Aug. 28.—He discusses the cost of placing accumulators at the end of a feeder. According to Wright extra current at times of moderate load could be generated and supplied to consumers for about 1.5 cents per kw-hour; charging accumulators at the end of a feeder and allowing a watt efficiency of 66 per cent., the generating cost of the current supplied in this way will be about 2 cents; he then estimates the additional sum to be added for first cost, maintenance and attendance; the cost of the accumulators he takes as $95 per kilowatt, of which $65 is for the accumulators and $30 for the buildings, boosters and accessories; this is for discharging at the rate of three hours; allowing a depreciation of 7 per cent. on the accumulators, interest, attendance, etc., the annual cost per kilowatt on a three hours' discharge basis per day amounts to $11.70; at least 75 per cent. of this annual cost is constant whether the battery is used much or little and it should therefore be used as fully as circumstances will permit; he shows that the use of accumulators up to a certain point would be economically desirable even when in the central station itself, besides the other advantages which they confer; when placed at the end of the feeders in many cases equally economical results would be obtained; this removal will also effect great changes in the feeder system; a greater drop may be allowed and the total cost of the feeder may be reduced to one half, which is a very great gain. He compares briefly such systems with the high-pressure alternating system or with the continuous system and motor generators, neither of which can work more economically so far as generating expenses are concerned, and concludes that transformer systems, whether alternating or direct, should be adopted only with caution.

Water-Power Installations in Switzerland. Lond. *Engineering*, Aug. 28.—Brief descriptions of some of the installations visited by the recent Congress at Geneva; they include those at Fribourg, Val de Travers, Chaux-de-Fonds, Locle, Neuchatel, Berne and Wynau.

Lightning-Protecting Devices for Heavy Current Installations. Lond. *Elec. Rev.*, Aug. 28.—The beginning of the translation of the article abstracted in the *Digest*, July 11.

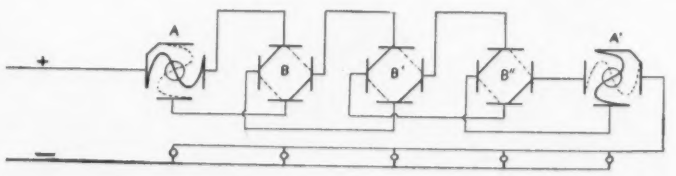
Lightning Arrester. Baxter. *Elec. Eng.*, Sept. 9.—An illustrated description of a form devised by him which has been in use on railway cars with good results. There is a row of stationary metallic insulated blocks, over which is another row of smaller blocks placed so as to bridge the spaces between the others, and fastened to a lever arm connected with a magnet by means of which they may be separated from the others, in order to extinguish the arc; the discharge passes from the first lower block to the first upper one, thence to the next lower one and so on through the series of contacts between these blocks; the contact surfaces are filed so as to be nearly in line but not more than two of the points will actually be in contact, all the others being separated by very small gaps which will be sufficient to prevent the line current from jumping and as the gaps are exceedingly small they afford a path of very low resistance to a lightning discharge; one of these gaps is purposely made larger and is shunted by a magnet so that if the current from the line follows the discharge it will pass through the magnet, which in turn will separate the blocks from each other, thereby extinguishing the arc; the advantage of the construction is that the width of the air gap can be greatly reduced; the number of blocks should be in proportion to the voltage of the line.

Local Development of an Electric Central Station. West. Elec., Sept. 12.—A reprint of the article noticed in the *Digest* last week, describing the Edison station in Brooklyn.

Neu hatel. West. Elec., Sept. 12.—A translation in abstract, with some of the illustrations of the article noticed in the *Digest*, Sept. 5.

WIRES, WIRING AND CONDUITS.

Two-Way Switches. Lundberg. Lond. *Elec. Rev.*, Aug. 28.—He describes the system shown in the accompanying diagram, for staircase



lighting; by turning any one of five switches the lamps may be lit or extinguished; the dotted lines show the alternative positions of each switch.

Alternating-Current Concentric Mains. Berry. Lond. *Elec. Rev.*, Aug. 28.—He refers to a recent statement by Fleming (see *Digest*, Sept. 5), in which it was said that the outer member of a concentric main should be connected to its bus-bar first before the inner member is connected; the present writer states that this would often severely strain

cables of even less than a mile; he gives the correct method as follows, accompanying the same by a diagram: First connect the outer conductor to its bus-bar, then connect one end of the primary coil of a suitable transformer to the inner main, the other end of the coil being then joined to the inner bus-bar, the secondary of the transformer being open-circuited; this secondary is then closed through a high resistance, which is gradually reduced; the primary coil is then short-circuited, leaving the main connected directly to the bus-bar; when disconnecting the main the reverse process should be followed. The transformer for this purpose should have an impedance of the primary, with an open secondary, which is so much greater than the impedance of the main that practically the whole of the applied pressure is absorbed across the primary coil; the section of the primary winding must be sufficiently large. In conclusion he gives a formula by means of which the rise of voltage can be calculated.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Properties of Electrolytic Iron. LEICK. Lond. *Elec.*, Aug. 28; abstracted briefly from *Wied. Ann.*—Iron deposited from a 3 per cent. solution of ferrous sulphate and salammoniac is very much like hard steel in its magnetic behavior, and not like soft iron, as is often supposed; soft iron may be saturated in a field of 10 units, while electrolytic iron requires over 90; the iron plates were only a few millimetres thick, and were hard and lustrous; they showed an extraordinary amount of permanent magnetism, usually 65 per cent. of the temporary; it is thought probable that if the plates were infinitely thick the percentage would closely approach 100. Experiments were also made with nickel and cobalt; a mixture of iron and nickel, such as found in meteorites, was also obtained electrolytically from the mixed salts; with about 5 per cent. of nickel the intensity of magnetization could be brought to 1830 units, the highest value on record with any substance.

Diffusion of Röntgen Rays. MUELLER. *Wied. Ann.*; noticed in the Lond. *Elec.*, Aug. 28.—He obtained shadowgraph of a wire grating in the penumbra of a brass cylinder; the rays seemed to pass around the cylinder to the plate; it was a case of something like diffusion and not diffraction, as no interference bands could be obtained.

Röntgen Rays. KOENIG. *Zeit f. Electrochem.*, Aug. 5.—A reprint of a recent paper with the discussion; it is general in character and appears to contain nothing new; in the discussion Consntam suggested that the deflection of the cathode rays by a magnet might be due to the occluded oxygen.

Simple Mercurial Pump for Röntgen-Ray Tubes. WOOD. Lond. *Elec.*, Aug. 28; abstracted from *Wied. Ann.*; No. 5, page 205.—A very brief description of one illustrated in the *Digest*, May 16; an additional illustration showing the complete apparatus is given.

Theory of Contact Electricity. NERNST. *Wied. Ann.*; noticed in the Lond. *Elec.*, Aug. 28.—He works out a theory of contact electricity based on an application of the laws of diffusion to the motions of the ions, and gives a valuable equation for the calculation of differences of potential from the ionic mobilities.

Deleterious Effects of X-Rays on the Human Body. JONES. *Elec. Rev.*, Sept. 9.—A note stating that some time ago he undertook to locate a bullet embedded in the head of a man, which necessitated prolonged exposures; inside of 24 hours every spot on the head which had been exposed to the rays commenced to blister and turn into bad sores, similar to a burn; all the hair on that side of the head came out; two good pictures of the bullet were obtained showing its location; he considers that there is no doubt of the deleterious effects of these rays.

ELECTRO-CHEMISTRY AND BATTERIES.

Progress in Accumulators. VOGEL. *Zeit. f. Electrochem.*, Aug. 5; a reprint of a paper.—He limits himself to those plates in which the active material is mixed with some organic substances in order to give it greater strength; in those considered the intention is to have a true chemical reaction between the organic bodies and the oxides of lead (most of the mixtures have already been referred to in these columns); some of the capacities obtained are given in terms of the weight of the positive electrode; in one case a capacity of 63 ampere-hours per kilogram was obtained and in another 73; in the accumulator of Meissner the oxides are mixed with vegetable alkaloids; Linde uses the bitter principles, such as aloin, santonin, etc.; 67 ampere-hours per kilogram of positive plate were obtained with these. In the discussion POLLAK urged that capacities should always be referred to the weight of the complete accumulator ready for use and not given in terms of the weight of single plates; he obtained the best results by using the purest materials, the purer the lead, the acid, the water, the better will be the results for extended periods. SIEG confirmed the latter remark; it is easy to increase the capacity of an accumulator by the mixture of organic materials with the lead, but this is done at the cost of the life; any mixture of organic materials is necessarily accompanied by a very rapid destruction of the plates; he obtained very unsatisfactory results with glycerine; it was more difficult to form the plates, after the glycerine was decomposed. LIEBENOW endorsed the latter remarks and added that when glycerine is used, most if not all of it must be decomposed before the plates are completely formed; the organic substances which are used to make the plates are no longer present in the finished accumulator. VOGEL claimed that the latter remark did not apply to all organic materials. POLLAK stated that as soon as the active material in a Planté cell is one third of a millimetre thick it falls off. CORRENS stated that the binding materials which have been suggested to make the materials harder, are effective only so long as they are not decomposed by the current, but this decomposition takes place constantly with every new charge; success can be obtained only with those which either form an undecomposable framework or those which form with the lead oxides an undecomposable body; up to the present time experience has shown that the best results are obtained from the purest compounds of lead in combination with a suitable frame. VOGEL stated that he had accumulators in his house which in spite of unfavorable treatment had lasted for three years and which were originally made with the aid of organic materials.

Reactions in Accumulators. LIEBENOW. *Zeit. f. Elek.*, Aug. 5.—A reprint of a paper deducing an empirical formula for the effect of the thickness of the plate, which gives the capacity in terms of the thickness of the plate and the discharge current; experiments are described for determining the effect of the current on the capacity, the measurements of the voltage being made between each plate and a rod of zinc; he shows that spongy lead and peroxide are formed in layers on the same plate under certain circumstances; he also discusses the question whether lead will dissolve hydrogen.

Theory of the Lead Accumulator. ELBS. *Zeit. f. Electrochem.*, Aug. 5.—A short article in which he endeavors to show the existence of lead ions having an equivalence of four, explaining thereby the formation of the peroxide of lead.

Terminals for Battery Zincs. Lond. *Elec. Rev.* and *Elec. Eng.*, Aug. 28.—An illustrated description of a new form in which the wire soldered to the top of the zinc passes through a small wire loop a short distance above the zinc, the object being to prevent the wire from being broken off short at the zinc due to bending it.

Thin Metallic Septa in Electrolytes. ARONS. *Wied. Ann.*; noticed in the Lond. *Elec.*, Aug. 28.—He describes experiments on the action of thin metallic septa in choking the current flowing through an electrolyte and shows that all the phenomena may be explained without the assumption of the existence of microscopic holes.

Electrochemical Measurements. NERNST. *Zeit. f. Electrochem.*, Aug. 5.—A short paper giving references to descriptions of the principal instruments and methods.

Electrochemical Instruction at Technical High Schools. VON KNORRE. *Zeit. f. Electrochem.*, Aug 5.—A reprint of a paper giving a plan of a building, suggestions for a course and a series of experiments.

Practical Results in the Electrolysis of Chlorides. HULIN. *L'Ind. Elec.*, Aug. 25; an abstract of a paper read at the International Congress of Applied Chemistry.—Editorially the paper is thought to be one of the most interesting of its kind; it describes a successful application of the electrolysis of fused chlorides. If instead of a cathode of carbon, a bath of lead is used, the sodium will form with it an alloy which can be decomposed by water, giving caustic soda and spongy lead; Vautin suggested a similar process but encountered great practical difficulties in applying it on a commercial scale; the present writer has overcome these difficulties; one of the worst is that the process is erratic, as the action often stops suddenly and periodically without any apparent cause; at these times the dynamo, whose normal voltage is 7, increases up to 20 and more volts until the current stops completely, the heat for the fusion is furnished by the current. He observed that the sodium is first absorbed perfectly but it does not diffuse, a light alloy forming on the surface in the form of globules, which is not prevented by stirring; at the same time a part of the sodium recombines with the chlorine and the bath heats abnormally, the production of chlorine diminishes, the voltage rises and the current stops; to continue the operation the anodes must be removed from the bath for some minutes; the refractive material will be found partly decomposed and the bath will have become pasty; when the current stops there is a strong reverse current; all this is due to the sodium being formed in a globular state; the efficiency in sodium is naturally very low and very variable. After a number of researches he was led to the following remedy, namely, to electrolyze a mixture of constant composition, of chloride of sodium and chloride of lead; the stopping of the current and the destruction of the anodes then no longer takes place; it facilitates the union of the two bodies; the amount of chloride of lead must however be small and it must be added at a regular rate; in the melted chloride of sodium there are open receptacles of carbon or refractory material containing lead but not in contact with that of the cathode; a shunt circuit from the positive pole carries a fraction of the current to these receptacles so that the lead in them acts as a sort of supplementary anode; the density of the current varies between 6000 and 10,000 amperes per square metre in place of 300 as in the wet process, and is therefore about 25 times as great; the feeding of the chloride of lead requires about 12 per cent. of the total current, which represents the price paid for a perfectly regular action; one can count on a production of 0.081 kg of

chlorine and 0.054 of sodium per hp-hour at the shaft of the dynamo; the alloy of lead and sodium contains from 23 to 25 per cent. by weight of sodium; the oxidation of the sodium by water is preferable to that by steam; a concentration by progressive saturation without evaporation can be obtained up to 40 degrees; the soda does not contain a trace of lead; the loss of lead is about 0.5 per cent., and the efficiency is very satisfactory; the losses by the handling and the vaporization are at most 4 per cent. This process was developed and is used in a paper factory at Modane, France. As other industrial applications of this process he cites the simultaneous oxidation of the elements of the amalgam (alloy?) at a red heat, the lead being transformed into peroxide, which combines with the alkaline oxide to form an anhydrous plumbate; in water the peroxide is liberated in a very finely divided state and is easily separated from the caustic soda; this can be used in the manufacture of accumulators, in which a frame or grid is filled with this alloy containing about 18 per cent. of sodium; the addition of nitrate of soda of a density of 1.16 to the water will keep the lead oxide from falling to pieces. Alloys of sodium and zinc or sodium and tin may also be formed. The last part of the paper refers briefly to the wet process with which he also experimented; his object was to carry off the cations immediately as they are formed, by filtration; the cell is divided into two compartments, one of which contains the liquid to be electrolyzed and an anode of carbon; the diaphragm is made of porous carbon connected to the negative pole and serving as a cathode on that side which is toward the electrolyte, while at the same time it is a filter for the soda which is formed, enabling it to pass into the other compartment; the density of current is 4 amperes per square decimetre and the voltage 4.3, although 2.5 amperes and 3.5 volts are preferred; the efficiency is 82 to 85 per cent.; the purity of the product varies inversely as the efficiency; if the filtration is more rapid than the electrolysis, the efficiency is 92 per cent. and the soda contains 15 to 20 per cent. of the undecomposable salt, but if the electrolysis is more rapid than the filtration the efficiency is 78 to 80 per cent., but the soda contains only 3 to 5 per cent. of the undecomposable salt; the solution of soda thus prepared has a density of 1.16 and contains 13 per cent. of caustic soda without a trace of the hypochlorite.

Electrolysis of Alkaline Chlorides. Lunge. *Eng. & Min. Jour.*, Sept. 5.—An article giving some historical information in connection with such processes.

Manufacture of Chlorate of Potash at Niagara Falls. Dunlap. *Elec. Eng.*, Sept. 9, and *West. Elec.*, Sept. 12.—A short, illustrated article describing the works of the Chemical Construction Company where chlorate of potash is being made; it is intended also to make chlorate of soda, chlorate of barium, chloroform and iodoform; 4000 horse-power are available, but at present only 500 are in use. The process of the manufacture of chlorate of potash is briefly described and some of the apparatus illustrated; the capacity is about one ton per day; two rotary transformers of 250 horse-power are used with four "static" transformers giving 3000 amperes at 60 volts. This is said to be the first factory of the kind in this country, and that no chlorate of potash has ever before been made here by chemical or other processes; there are no bi-products; the salt is imported from Stassfurt, Germany; carbon anodes are used in place of platinum; it is stated that the voltage is extremely low and that the cost of production will be much less than by the chemical process; the Blumenberg process is the one used.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Standard Mercury Ohm. Jaeger. Lond. *Elec.*, Aug. 28; translated from *Zeit. f. Instrumentenkunde*, May, page 134.—A long, illustrated article on the mercury ohm of the German Reichsanstalt, giving a summary of the investigations undertaken by that institution for preparing the legal mercury standards of electrical resistance for Germany; the preparation of the standard mercury resistance, as defined in the legal specifications for the ohm, is the duty of this institution; the unit was less accurate than the methods of measurement, as the latter may easily be made to a millionth part of their value, whereas the accuracy of the reproduction of the unit hardly attained one one hundred thousandth. He discusses the geometrical computation of the resistance of mercury standards, consisting in the calibration of the tube, the measurement of its length and the weighing of the mercury; also the electrical resistance measurements, which were made in a bath of ice so as to eliminate the temperature coefficient; the Kohlrausch secondary cross-circuit method was the only one available for the comparison of the resistance. The measurements showed that the mercury copies were constant to within one or two hundred thousandths; they completely established the constancy of the standard tubes and the manganin resistances to within one or two hundred thousandths; it may therefore be taken for granted that these units, the standard tubes, the mercury copies and the wire resistances, can remain constant for two years to within this limit. Illustrations of the standard tubes are given. The subject is discussed editorially, in which it is thought that he is scarcely justified in claiming the accuracy which he does; the permanency of the mercury unit, it is thought, is not yet established; before it can be ranked as a standard there should be more reproductions of it by different workers.

The Work of the Reichsanstalt. Lond. *Elec.*, Aug. 28; an extract of a report which appeared in the *Zeit. f. Instrumentenkunde*, July, covering the period up to Feb. 1.—Only a few of the subjects mentioned are electrical. The platinum standard of light is said to have been satisfactorily fixed by defining the temperature by the proportion between the total radiation and the radiation transmitted by a layer of water 2 cm thick between quartz plates with a total thickness of 0.2 cm. Regarding the preparation of pure zinc it was found that Lorenz's method of electrolyzing the fused chloride with carbon electrodes gave very good results; cadmium could be obtained in a state of extraordinary purity by electrolysis of the neutral sulphate and sublimation in a vacuum; the impurities will not exceed 1 part in 100,000.

Testing Department of the General Electric Company's Works. Straus. *Elec. Eng.*, Sept. 9.—The beginning of an article, the present portion of which describes the construction of the building and very briefly the system of the wiring; it includes some of the interior views.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Postal Telegraph Service. Lond. *Elec.*, Aug. 28.—An extract from the annual report of the Postmaster General for the year ending March 31, 1896. A very satisfactory increase is shown in both the inland and the foreign telegrams; during the year 78,839,610 telegrams of all descriptions were forwarded, which was an increase over the previous year of 10.12 per cent.; almost half of the increase was in London alone; the revenue returns are obscured by different modes of computations indicating a deficit in one part and a substantial surplus in another.

Budapest International Telegraph Conference. Jour. Telegraphique, Aug. 25.—The first part of what appears to be quite a complete report of the proceedings. (See also *Digest*, Sept. 5.)

Cycle Telegraphs in War. Sc. Amer., Aug. 29, reprinted in part in the *West. Elec.*, Sept. 5.—A brief note referring to some recent experiments made by the United States Army for laying and reeling up again a provisional telegraph wire, by means of a bicycle; the reel is carried on the wheel and is paid out as the bicycle proceeds; it was found that this could be done quickly, as also the recovery of the wire; the reel held about one third of a mile of cable and it appears that the time of paying it out and picking it up again was only two minutes. An illustration is given of a similar system devised by Kamm, of London; in this the apparatus for laying the wire weighs seven pounds and each mile of wire weighs 10 pounds; this machine was used at the recent Aldershot manœuvres.

Telephone Register. Muench system. *Elec. Eng.*, Sept. 2.—A brief illustrated description of the device, which is cheap and easily applicable to existing systems; the operation is effected by single-current impulses through an electromagnet which moves the registering mechanism; the plug used for connecting the two subscribers operates the circuit-closing devices; the magnet, by means of a ratchet, turns a worm which engages in a wheel having a dial and suitable pointers; if the duration of the conversation is also to be recorded a clockwork is inserted in the local circuit.

Cable Steamer "Tutanekai." *Elec. Rev.*, Sept. 9.—An abstract of the article noticed in the *Digest* last week giving an illustration and description of the cable-laying gear on this steamship.

MISCELLANEOUS.

Meeting of the German Electrochemical Society. Zeit. f. Electrochem., Aug. 5.—The conclusion of the complete report of the proceedings, including all the papers and the discussions, which are noticed in these columns under their respective headings.

International Congress at Geneva. Lond. *Engineering*, Aug. 28.—A continuation of the report of the proceedings, the present portion being devoted to brief descriptions of the plants visited.

International Congress at Geneva. Lond. *Elec. Rev.*, Aug. 28.—A translation from the German of the reports abstracted in the *Digest* last week.

Instruction. Lond. *Elec. Rev.*, Aug. 28.—A translation of the curriculum of the technical school under the auspices of the International Society of Electricians in Paris, noticed in the *Digest*, Sept. 5.

Scientific Education in Germany and England. Oswald. Lond. *Elec. Eng.*, Aug. 28.—A reprint of a letter to Prof. Ramsay.

International Congress at Geneva. Hospitalier. *L'Ind. Elec.*, Aug. 25.—The beginning of a report of the proceedings; the present portion refers to the photometric and magnetic units, quantities and nomenclature (see *Digest*, Sept. 5, and The Electrical World, Sept. 12, p. 299).

Carbide of Calcium. Eng. & Min. Jour., Aug. 29.—A brief announcement of the discovery of a new process of manufacturing this material, invented by Patin, of Paris; it is in actual practical operation in Paris, and it is claimed the cost has been reduced to $40, or by water-power to

$30 or $35; no further information is given, nor is it stated whether the process is an electric one or not.

Industrial Interests in Electricity. STOCKBRIDGE. *Eng. Mag.*, September.—An article of a general character on "Shifting Lines of Industrial Interests in Electricity." It is reprinted in the *Elec. Rev.*, Sept. 9.

Geneva Congress. Elec. Rev., Sept. 9.—An abstract of the reports from Lond. *Engineering*, which are being noticed in these columns.

New Books.

THE THEATRICAL GUIDE. By Julius Cahn. Containing Information of the Leading Theatres and Attractions in America. Publication Office, Empire Theatre Building, New York.

This guide sets forth the various branches of the theatrical business, arranged in a clear and concise manner, which makes it valuable and available as a book of reference for managers of theatres and of traveling attractions. Its interest to the electrical profession lies in the fact that it states which theatres are electrically equipped, the number of lights which each contains and the name of the electrician of every such theatre in the United States. We are not in a position to estimate its value to the theatrical fraternity, but believe from the complete manner in which the various facts are presented that a guide of this kind will fulfill the aims of its compiler.

ELECTRIC ARC LIGHTING. By Edwin J. Houston, Ph. D., and A. E. Kennelly, Sc. D. New York: The W. J. Johnston Company. (Elementary Electro-Technical Series). 393 pages. Price, $1.

This volume gives an account of arc lighting up to the present time, including the early history of the art. Although one of a series of elementary books on electricity, this volume is, like the rest of the series, complete in itself, and presented in a manner to make the subject as simple as possible to those who have not made electricity a study. The mechanism of a number of different types of lamps is shown, giving a good idea of the present practice. It would be beyond the scope of a small volume to show anything more than the principal types in present use, as the number of lamps which have been used at different times, even on a commercial scale, is very large. The different methods of operating lamps, in series and parallel and with continuous and alternating currents, are described. There is a chapter on light which gives a good general idea of the subject, and all that is necessary for the practical man to understand in order to deal intelligently with the cases that present themselves in actual work.

ELECTRIC LIGHTING SPECIFICATIONS. By E. A. Merrill, A. M. Second edition. Entirely rewritten. New York: The W. J. Johnston Company. 213 pages. Price, $1.50.

The preface states that the book is only intended for those who are competent to determine the engineering questions involved in their work for themselves. That is, the book is not intended to embody an engineering education, but only to give instruction in the matter of drawing up specifications properly. The proper office of a book of this class is to show how to draw up specifications that can be legally enforced and that are as free as possible from ambiguities and chances for misunderstandings between the contracting parties. This is also the avowed object of the present volume, which object seems to have been attained. The book begins with a "working outline" of a specification. This consists of a tabular form embracing under a few general headings a larger number of sub-headings, which are again sub-divided until a sufficient degree of particularity is reached. By keeping this working outline in sight the labor of preparing a specification in detail is greatly facilitated, and the liability of omitting anything of importance is lessened. The main portion of the book goes into all the necessary details of wiring, generators, motors, storage batteries, etc., for the different kinds of service; that is, arc and incandescent systems, alternating and direct currents of different potentials, steam engines and other machinery, and the installation of the same. The rules of the National Board of Fire Underwriters are inserted in full, as they are a *sine qua non* in most installations. A form of contract is also given, which has been adopted and recommended for general use by the American Institute of Architects and the National Association of Builders. This form of contract appears to leave no room for misunderstanding. Altogether the book is well arranged, and will doubtless prove to be very useful in the preparations of specifications.

India Rubber.

In a report on the industries and economic products of Para and the States of Amazonas, Mr. C. B. Rhind deals with the great importance of the rubber industry. He states that the abundance and ease with which rubber is obtained and disposed of in these districts secures for it almost exclusive attention. He places the exports from 1836 to 1852 at 169,114 pounds as compared with 86,196 pounds per annum from 1853 to 1862. India-rubber now represents two-thirds of the total value of its exported productions. During the years 1894 and 1895 the exports represented 18,060,647 pounds having a value of $7,801,500. How much of this is of Para origin and how much comes from the Amazonas is a question. Mr. Rhind combines the exports of the entire rubber district, which result shows 45,693,000 pounds for 1895 of which 20,940,000 pounds were shipped to Europe, and 24,753,000 pounds came to the United States.

The Electrical Equipment of the "Bouvines."

We recently called attention to the complete electrical equipment of the United States battleship *Indiana* so that the brief reference below to one of France's most formidable ironclads will prove of interest.

According to the London *Electrician* the *Bouvines* is of 6600 tons displacement. With the exception of the revolving mechanism of the two big turrets containing the two 30-centimetre guns, all the auxiliary machinery of the *Bouvines* is driven by electricity; helm-indicators, ventilators, shot-hoists, etc. The generating plant consists of four 400-ampere, 80-volt two-pole direct-coupled Sautter-Harlé dynamos, all situated in the main engine-room of the ship. The lighting is carried out by 460 ten-cp lamps, 34 thirty-cp lamps and 17 fifty-cp lamps. There are five 70-ampere projectors, all electrically operated from a distance. The motors number 20, of which eight are allocated to ventilating fans, and the rest, with one exception, to shot hoisting. A 10-ampere servo-motor works the valve gear of the steam-steering engine. As the helm revolves, contacts are successfully made which ring a bell and light up a group of glow lamps in such a manner as to indicate the position of the rudder. This curious method of indication has been, we may remark, subjected to considerable adverse criticism from competent naval men.

Improved Gas Engine.

Jacob Brombacher's Sons, 31 Fulton Street, Brooklyn, N. Y. last week gave an exhibition test for the benefit of the technical papers on a new gas engine of their manufacture. This engine was described in the May 9, 1896, issue of THE ELECTRICAL WORLD. A few slight changes have been made in the electrical arrangement, the dynamo being driven direct instead of from a counter shaft.

Eighty-one 16-cp lamps were run at 112 volts for one hour, the consumption of gas for that time being 210 cubic feet.

The manufacturers' faith in the superiority of their engine is demonstrated in the facilities which they offer to a prospective purchaser or his engineer to fully assure himself as to the efficiency and satisfactory operation of this engine.

A gas meter, a voltmeter, an ammeter and a load of lamps, either incandescent or arc, are provided together with the necessary switches so that as satisfactory a test as is possible with the apparatus can be made at any time.

The Wurts Switches and Circuit-Breakers.

The Westinghouse Electric & Manufacturing Company will exhibit at the St. Louis Convention, in October, a complete new line of switches and circuit-breakers designed by Mr. Alex. Jay Wurts. The instruments are remarkable for ingenuity and tasteful design, and will entirely revolutionize the trade in this class of instruments.

The switches are especially remarkable for their novel method of making contact and for their great carrying capacity, occupying, as they do, only half the space of an ordinary switch.

The circuit-breakers are designed on entirely new principles, every detail of which has been most carefully worked out and perfected by the inventor. The distinctive features are the absence of contact jaws and solenoid, the delicate ease of adjustment over a wide range and the ingenious manner in which all possibility of burning at the main contacts is avoided.

It is expected that these instruments will attract much attention at the convention. A beautifully illustrated pamphlet, descriptive of the instruments and new principles involved, is now being prepared and will be ready for distribution among the many friends of the Westinghouse Company who will attend the convention.

Lachine Rapids Power.

The corner stone of the main dam and power house of the Lachine Rapids Hydraulic & Land Company, Lachine, Can., was laid in the afternoon of Sept. 12. A large and representative party was present by invitation.

The Adams-Bagnall Arc Lamp.

The underlying feature of the Adams-Bagnall arc lamp is the chain used for moving the carbons, one end of it being fastened to the positive and the other to the negative carbon, so placed that by suitable mechanical means the ends "nose" together. As the upper carbon descends the lower carbon ascends at an equal rate so that if the carbons are of the same size and the current is alternating the arc will be perfectly stationary with respect to the globe. With direct currents the arc is maintained practically stationary by using a large positive and small negative carbon. This has the additional advantage that the light from the crater of the positive carbon is not so largely shadowed by the negative carbon and more light is thrown down.

The advantages of the stationary arc are quite notable. The traveling arc causes varying heat conditions on the globe, with the result that the globes frequently crack. With the stationary arc its position may be located with reference to the globe so that the heating effects will be equally distributed.

In Fig. 1 a general view of the mechanism of the lamp is shown. A chain is shown attached to a weight, to the end of which is fastened a

rod. This rod is grasped by a clutch which is operated by a system of levers connected to the magnet armature. Connected to this weight is a little arm on which is a clasp which grasps the positive carbon. This carbon passes through a lava bushing in the base of the lamp case. The negative carbon passes through the little retaining ring which causes it to "rise" accurately with the positive carbon, and as the joints holding the ends of the carbon in place are universal, bent carbons can be used with just as great facility as straight ones, an advantage that every lamp trimmer will appreciate.

As the weight descends to the end of its travel, it manipulates a little latch. When the carbon is nearly burned out a little insulated arm pushes this latch aside and as it falls in place it makes the proper connection and short circuits the lamp unless it is of the constant-potential type, in which case the carbons are simply allowed to burn apart. The moment the carbons are short-circuited in the series-lamp by the cut-out just described, the coarse coil is cut in circuit and the weight on the end of the feed rod is drawn up so tightly against the latch that it is practically impossible to unlatch it unless the lamp is short-circuited by the handle at the top of the case. The latch may then be opened, the carbon holder raised and the lamp trimmed. This powerful contact between the latch and the notch into which it slips is maintained by a magnet having a coil of very low resistance.

It will be noted that this cut-out is entirely mechanical and that no extra bobbin is needed. The parts of the lamp just described apply to all arc lamps made by the Adams-Bagnall Electric Company.

They are adapted for alternating currents, series arc circuits and constant-potential service by merely changing the spools that actuate the movement.

In Fig. 2 some of these spools are shown. The two views at the left are series spools, while the spool at the extreme right is used in the alternating-current lamp. The series spool is very ingenious. The magnetic circuit is completed by an iron strap brought around from the rear end

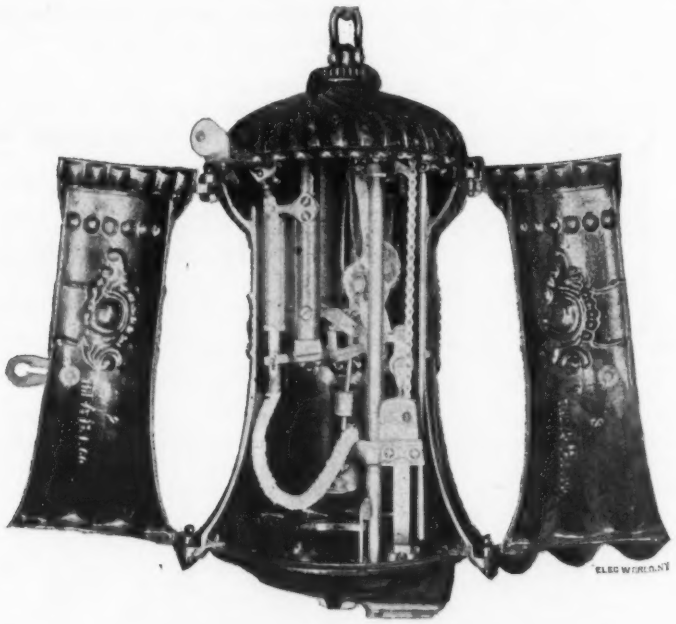


Fig. 1.

parallel to the core. The ends of this U-shaped strap project beyond the spool head, as does also the internal core. Two little blocks of laminated iron work in the two gaps thus formed, and as the blocks are secured to a pivoted brass frame they form the armature. When the magnet coil is energized by a current the magnetic circuit tends to shorten itself, drawing up the armature and operating the lamp. The power required to attract the armature, as is well known, increases more rapidly than a straight line function, therefore it is necessary to add weights which come into play as the armature approaches the limit of its motion. This is accomplished in two ways, first by the little weight which takes hold at a certain position, and which, as it is drawn upward, increases the leverage; second by the dash pot. It may be noted that the rod connected with the dash pot is slotted and therefore the latter will not come in play until the armature has been drawn up some distance. The piston of the dash pot is a leaden weight, and really there is so much play between the piston and the side of the cylinder that there is very little dash-pot action. This part of the mechanism is for the purpose of obtaining the effect of the added weight as the armature approaches its most powerful position.

The electrical connections of the coil are interesting, and are different from any other arc lamp on the market. They are shown in Fig. 3. The bobbin is wound around with coarse and fine wire coils. When the armature falls the carbons are raised and the coarse coil is cut across the lamp terminals by the switching mechanism shown in Fig. 3, and also at the extreme left of Fig. 2.

When the dynamo starts a current is sent to the lamp which energizes this coarse coil. The armature rises and the carbons run together. The coarse coil circuit is cut open by the automatic switch and also short-circuited by the carbons, so that the armature falls again. As it falls it pulls the carbons apart, and as the carbons are now carrying current, an arc follows. The fine wire coil is connected across the terminals of the lamp, and at the same time the presence of an arc causes a considerable

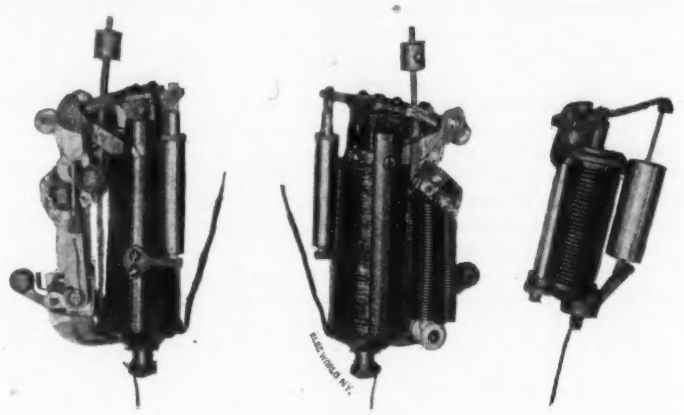


Fig. 2.

difference of potential at the lamp terminals. This causes the magnet to catch the armature before it has fallen to the limit of its motion. As the arc burns longer more current enters the fine wire coil, and the carbons are fed entirely by shunt regulation, the coarse coil being cut out altogether.

As the regulation depends upon the potential between the carbons and not upon the current in the lamp the latter may vary through wide ranges.

If the carbons should be broken or the arc ruptured in any way the shunt would become so powerful that it would pull the armature up to its limit and cut the coarse coil in again on the other side, as shown in Fig. 3. This time, however, it is cut in series with the external resistance.

Should the carbons run together at any time, the current passing through them would be enough to shunt away from the coarse coil sufficient current to allow the armature to fall. The coarse circuit would be opened and the shunt coil would take hold and feed the lamp as before. Thus with *one bobbin* all of the operations of ordinary arc lamps are performed.

The alternating-series solenoid has a laminated core. The movement of the core is checked by a dash pot, the operation of which is really the feature of the lamp. As is well known, an alternating arc lamp operated by a series-coil runs very nicely with the exception that on starting it chatters furiously and is often several minutes in striking the arc. The object of this dash pot is to check such action. The barrel of the dash pot is so shaped that at only one point is it contracted enough to choke on the piston and produce a dash pot action. This point is the one at which the carbons are opened and therefore they are rigidly held for the instant that they tend to chatter and the arc is started. Those who have experimented with alternating arc lamps know that by grasping the carbon and holding it still for a moment when the arc is starting, no difficulty will be had in striking it. This dash pot performs this service.

The changes involved in transforming the lamp from a series arc lamp to one suited for constant potential or alternating currents are merely to remove the screw from the top of the bobbin and disconnect one wire. The other bobbin is then screwed in place by one screw and connected with one wire.

The lamp has been designed in such a way that it can be sold at competition price. Where not needed no particular care is taken to make a

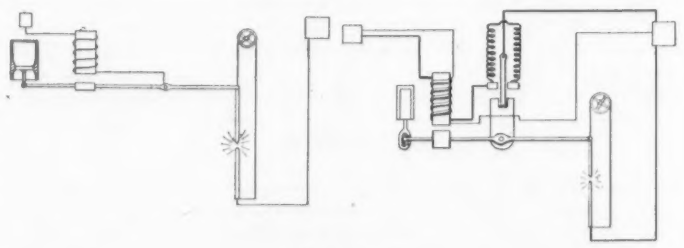


Fig. 3.

fine finish, but those parts upon which the operation of the lamp depends are made with great care. Nothing is neglected and no useless work is performed. The external appearance of the lamp is artistic and may be changed in finish to harmonize with its surroundings. The Adams-Bagnall Electric Company has entered the arc lamp field with successful and well-merited results.

A New 1500-HP Engine.

A new vertical direct-connected compound engine, designed to run at 185 revolutions per minute, is now being constructed by the Lake Erie Engineering Works, Buffalo, N. Y. It has one high-pressure cylinder exhausting into two low-pressure cylinders. These cylinders are to be arranged side by side and each is intended to take one third of the load. The valves of all the cylinders are flat, double ported and very nearly balanced. There are two valve chests, and two valves to each cylinder, each valve being driven by a separate eccentric ; thus there are six ec-

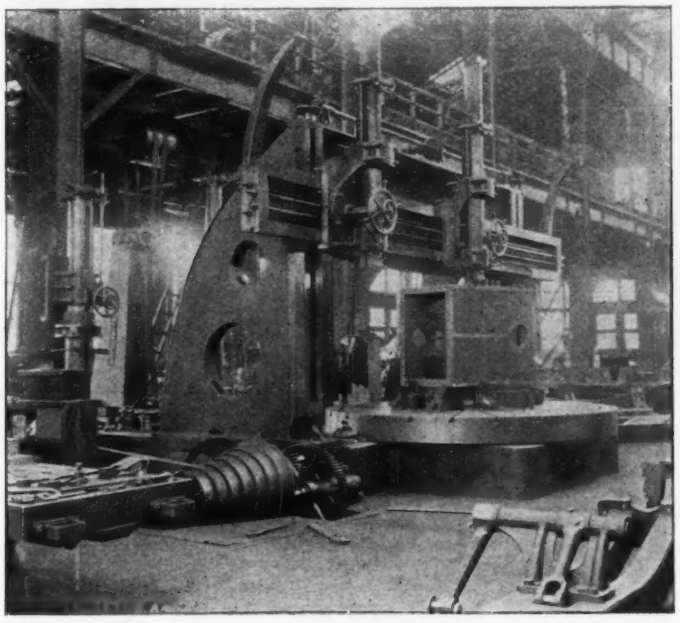


FIG. 1.—HIGH-PRESSURE CYLINDER ON BORING MILL.

centrics and six valves in all. The cut-off valve admits steam to the cylinder at four places through a hollow cast in the balance plate, and similar ample portage is provided for the exhaust. The valves at the two ends of the cylinders are fastened by hexagonal turnbuckles held in position by two hexagonal nuts. By this simple means the distance between the two parts of the valve may be varied as desired. This arrangement is shown in Fig. 2, which is a general view of the low-pressure cylinders. It also shows the balance plates and the method of securing them in place. The valves are of cast iron, mounted in rectangular brass frames so that each may be removed without altering the adjustment of the valve stem, and by simply taking off the balance plate the valve may be lifted from its position.

Fig. 1 shows the high-pressure cylinder on a large boring mill. The valve is removed and the valve seat shown. This mill is one of the heaviest made by the Niles Tool Works.

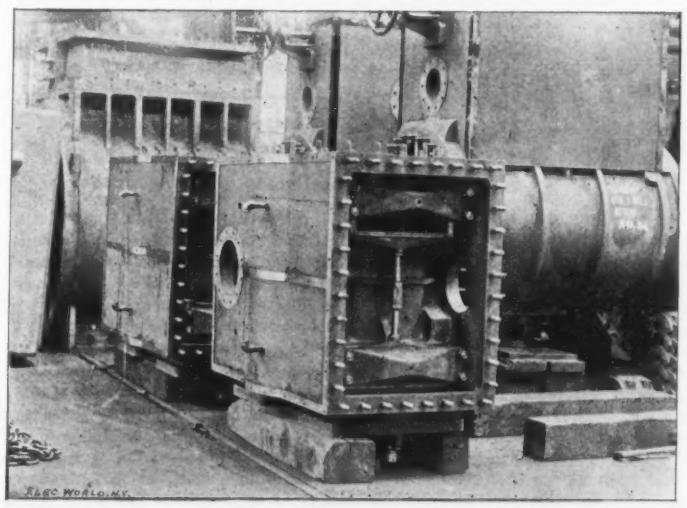


FIG. 2.—LOW-PRESSURE CYLINDERS.

The stroke of this engine is 32 inches, and the cylinder dimensions 30 inches for the high-pressure and 40 inches for the two low-pressure cylinders. The fly-wheel governor governs only the high-pressure cylinder, the other eccentrics being rigid on the shaft. The cylinders are steam-jacketed, lined and are designed to work non-condensing at 180 pounds steam pressure. The diameter of the shaft varies in different parts from 12 to 16 inches. It is made of three parts, an illustration of one of which is shown in Fig. 3 and two in Fig. 4. When complete it will weigh 13,400

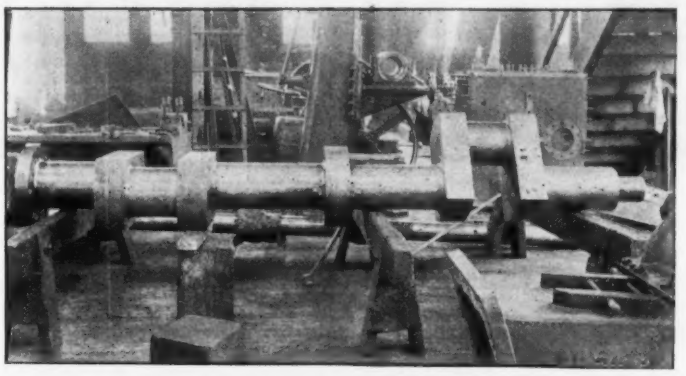


FIG. 3.—SECTION OF CRANK-SHAFT.

pounds. The three parts are secured together by six bolts passing through flange joints, as shown in Fig. 4. The cranks are solidly forged in one piece with the shaft. The crank pin was turned true by mounting the shaft in a lathe with plates secured to its ends, so as to enable the centre of the

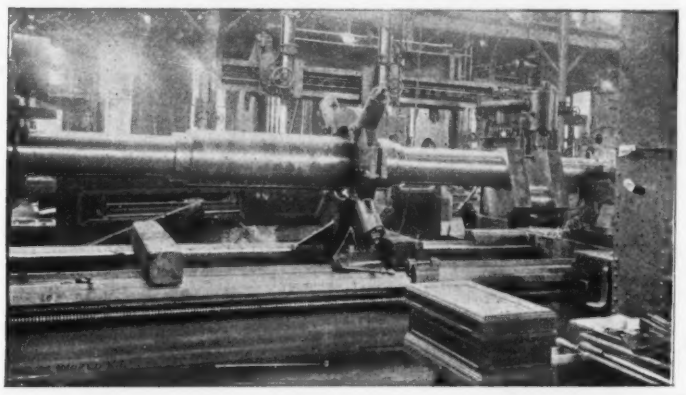


FIG. 4.—PORTION OF SHAFT TO SUPPORT ARMATURE.

crank pin to be set in line with the lathe centre. It was then balanced by an enormous weight fastened to the face plate of the lathe. The crank is cross-scraped and finished by hand and tested with a micrometer. The cranks are set 120 degrees apart. The shaft rests in six babbitt-lined bearings and one outboard dynamo bearing. The bearings are provided with rings for oiling and also with water jackets, so that a constant circulation of water may be maintained. The babbitting is done about a mandrel, and afterward bored. Four bolts secure each of the bearings to the bed plate (Fig. 5) with the exception of the end bearing, in which six bolts are used. The two bed plates, one for the engine and one for the dynamo, will be bolted together after the engine has been placed. The generator

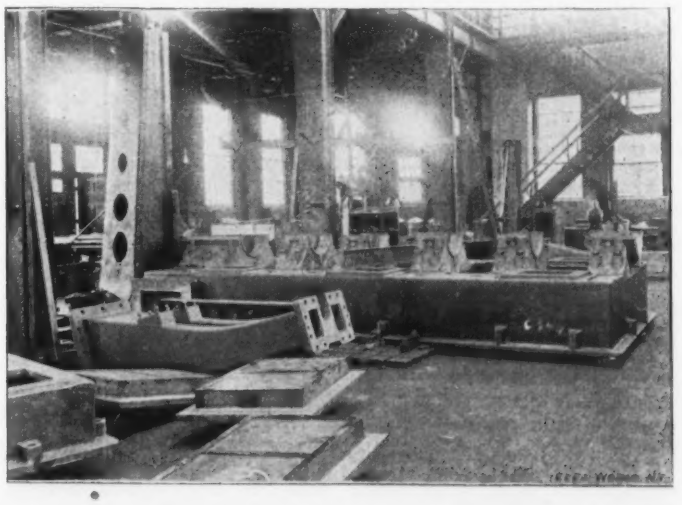


FIG. 5.—ENGINE BASE AND UPRIGHTS.

armature will serve also as the fly-wheel, and will weigh in the neighborhood of 45 tons. The weight of the complete engine will be 140 tons. The shaft sets very low, and therefore a large part of the generator will set below the engine room floor.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 12, 1896.

ELECTRICAL STOCKS.—Edison Electric Illuminating. of New York, shows an advance of two points. Electric Storage Battery, both common and preferred, show material advances, the former 4 points, and the latter 3½. General Electric was very quiet during the week, 16,704 shares having passed hands. The price was almost unchanged on the small trading, the highest being 27⅝; lowest 27½, closing at the latter figure. The net result is a decline of ⅜. No change is reported in Westinghouse securities.

TELEGRAPH AND TELEPHONE.—Western Union Telegraph received some strength early in the week in the declaration of the usual quarterly dividend, advancing thereupon 1⅜ per cent. The advance, however, was not maintained, and the stock closed with a net loss of ⅞ on the week's business. 15,860 shares changed hands. Bell telephone declined 1 point.

TRACTIONS.—The demand for street railway securities which revived the week before last was maintained last week, and prices generally advanced, fractionally. Buffalo Railway, which is now selling ex the quarterly dividend, more than regained this during the week, and was selling at about 64 at the close of the week. Brooklyn City stock advanced slightly, but the volume of trading was less than the previous week. A fair demand exists for the other most prominent stocks.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	..	..
Edison Electric Ill., New York	100	92	95
" " " Brooklyn	100	88	93
" " " Boston	100	..	..
" " " Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	27½	28
Electric Storage, pref	100	28½	29
General Electric	100	27⅜	27⅝
General Electric, pref	100	55	60
Westinghouse Consolidated, com	50	23	25
" " pref	50	48	49

BONDS.

Edison Electric Ill., New York	105	108	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	85	..

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	204	205
American District Telegraph	100	*29	39
American Telegraph & Cable	100	..	89
Central & South American Telegraph	100	124	127
Commercial Cables	100	125	..
Erie Telephone	100	56	..
New England Telephone	100	90	92
Postal Telegraph-Cable	100	77	80
Western Union Telegraph	100	80⅛	80⅜

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	15⅝	16
Brooklyn Rapid Transit		21	22
Brooklyn Traction	100	..	14
" " pref	100	46	48
Buffalo St. Ry	100	64	67
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	43	46
Hestonville	100	46	46¼
" pref		..	62½
New Orleans Traction	100	7	9
" " pref	100	..	60
North Shore Traction	100	21	25
" " pref	100	73	76
Rochester St. Ry	..	16	20
Steinway Ry	..	45	50
Union Railway (Huckleberry)		98	105
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	69	..
" " pref	100	85⅛	..
Worcester Traction	100	13	16
" " pref	100	84	86

BONDS.

Brooklyn Rapid Transit 5s. 1945	100	72½	..
Buffalo St. Ry. 1st con. 5s	100	101	*104
Cleveland Elec. Ry. 1st mtge 5s	100	100	*104
*Columbus St. Ry. 1st 5s	100	90	*95
Rochester St. Ry. 1st 5s	100	95	100
Union Railway (Huckleberry) 1st mtge 5s		100	*104
*Westchester Electric 1st mtge 5s	100	100	103

* With accrued interest.

ERIE TELEPHONE.—It is stated that the Old Colony Trust Company, Boston, trustee, has in hand $85,000 for the purchase of as many Erie Telegraph & Telephone 6 per cent. bonds of 1903, at not to exceed 105 and accrued interest, as the sum will absorb.

WESTERN UNION DIVIDEND.—The Western Union Telegraph Company has declared a quarterly dividend of 1¼ per cent., payable Oct. 16. The report of operations for the quarter ending Aug. 30, shows net revenues of $1,600,002, a decrease of $242,648 as compared with the same period last year; interest and sinking fund, $243,500, a decrease of $57; balance, $1,356,500, decrease $242.606. The total surplus is $7,808,232, a decrease compared with the same period of last year of $49.389.

FINANCIAL REPORT.—The Edison Electric Illuminating Company of Brooklyn reports gross earnings tor August of $60,652, an increase of $9324 as compared with the same month of last year, and net $23,058, an increase of $6110. For the eight months ending Aug. 31, the gross earnings were $523,081, an increase of $169,943 as compared with the corresponding period of last year, and net $228.331, an increase of $84,840. A quarterly dividend of 1½ per cent. was declared, payable Oct. 15.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, September 14 1896.

REMOVAL.—The offices of the *Iron Age* have been removed from 96-102 Reade Street to 232-238 William Street, near Chambers.

ILLUSTRATED LECTURE ON RÖNTGEN RAYS.—Friday evening, Sept. 25. a lecture will be given, in Association Hall, Fourth Avenue and Twenty-third Street, by Mr. Max Osterberg, E. E., A. M., on "The Possibilities and Limitations of the Röntgen Rays." Mr. Osterberg is the instructor in the evening class in electrical engineering at the Twenty-third Street Branch of the Y. M. C. A., and has kindly volunteered his services for this lecture, The proceeds will be devoted to securing apparatus with which to illustrate the instruction in the class-room. Besides exhibiting and explaining the Röntgen-ray apparatus, Mr. Osterberg will illustrate his lecture throughout with a stereopticon lantern.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Sept. 11, 1896.

THE ERIE TELEGRAPH & TELEPHONE COMPANY made a net gain of 331 subscribers in August, and a net gain for the eight months of this year of 1823. Total number connected Sept. 1, 20,414.

MCKINLEY AND HOBART BLOTTERS.—J. F. & C. G. Warren, manufacturers of oak bark tanned leather belting, Worcester, Mass, have issued over 20,000 McKinley and Hobart blotters. These blotters bear excellent likenesses of the two Republican candidates for President and Vice-President.

ASSIGNMENT OF AN ENGINE COMPANY.—The Armington & Sims Engine Company, Providence, R. I, has assigned and placed all of its property in the hands of a committee of creditors. A few weeks ago the company's creditors agreed to extend its notes. The insolvency of the estate of the late Henry C. Cranston, of Providence, is said to have been the indirect cause of the assignment.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
927 Chestnut Street,
PHILADELPHIA, Pa., Sept. 11, 1896.

CARPENTER ENAMEL RHEOSTATS.—Mr. James G. Biddle, 910 Drexel Building, Philadelphia, has been appointed selling agent for the Ward Leonard Electric Company, of Hoboken, N. J., and he will hereafter solicit orders for Carpenter enamel rheostats in addition to Weston voltmeters, ammeters and wattmeters. Mr. Biddle has also changed his address, and is now located at the number above given, having moved from 944, the same building.

RECORDING DYNAMOMETER.—Mr. R. M. Wilson, of this city, gives us some facts regarding a recent engine test near Stroudsburg, Pa., conducted by Edwin S. Boyer, M. E., of Philadelphia, at which a new form of recording dynamometer was presented. The dynamometer was the ordinary prony brake, but in place of the customary platform scales, at the end of the arm was placed a spring made of ½-inch steel, wound on a 2-inch core and designed from Begtrup's formula to be of such a length as to give a deflection of three inches under its maximum load of 2500 pounds. This spring was enclosed in a hollow cylinder which carried a scale. On the index of the spring was fastened a pencil which pressed against the card carried on an aluminum drum about $\frac{5}{16}$ inches in diameter and 3¼ inches high. This drum was so adjusted that the maximum movement of the index on the spring would be produced on the card. The cylinder was operated by clockwork to revolve once an hour. The ordinates on the card were divided into 25 spaces, each space therefore repre-

senting 100 pounds pull, and the abscissæ were divided into 12 spaces, each space representing an interval of five minutes. The duration of the test was eight hours, and indicator cards were taken every 10 minutes.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Sept. 10, 1896.

BALL ENGINES.—Mr. W. A. Kreider, manager of the Chicago office of the Ball Engine Company, Erie, Pa., has closed orders within the past week for one 100-hp and one 60-hp engine to go to Geneva, Ill.; one 100-hp and one 50-hp engine to go to Wauwatosa.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison St., Chicago, is making a large number of sales of its new telephone switchboard, which seems in every way to be a winner. It has a number of very desirable features exclusively its own, and is in every way a practical and serviceable board.

PITTSBURG EXPOSITION.—The Eighth Annual Western Pennsylvania Exposition was opened in Pittsburg on Sept. 9. Electrical appliances, it is stated, comprise the chief feature of the exhibition. The Westinghouse Electric & Manufacturing Company is represented by a large display of modern electrical machinery, and a Röntgen-ray outfit is one of the drawing cards.

THE ST. LOUIS SUPPLY COMPANY, St. Louis, Mo., has increased its capital stock to $45,000. Mr. Russell Stanhope has come into the company as a director. Mr. Stanhope is a very well-connected gentleman of English nationality and there is no doubt that the company's increased facilities and efficient management that has been secured by this deal will be very beneficial to it.

RECORD OF ENGINE SPEED.—We have received from the Edward P. Allis Company, Milwaukee, manufacturers of the well-known Allis engine, a reproduction of a chart record of speed regulation which was made by a Mescrop recording gauge attached to an Allis engine in the Green Street power-station of the People's Traction Company, Philadelphia. The record shows a practically constant speed under the varying conditions of railway work.

MR. J. H. PARSHALL, the Detroit representative of the Ball Engine Company, Erie, Pa., has been successful in closing several contracts for his company during the past three weeks. He has secured orders for one 100-hp engine for the Toledo Glass Company, Toledo, O.; two 50-hp engines, direct-connected to Walker dynamos, for W. H. Millikin for new hotel building, Bowling Green, O.; two 70-hp engines, direct-connected to General Electric generators, for Hammond Building, Detroit, Mich.

TELEPHONE CONDUITS.—John T. McRoy, Chicago, has secured and is carrying out a large order from the Central Union Telephone Company, of Indianapolis, Ind., for his conduit on the vitrified clay system. There will be six miles of trench and 220,000 feet of duct will be laid. The system will be constructed for the most part with the single duct-vitrified clay pipe laid in mortar and surrounded with concrete, four inches thick on the bottom and three inches on the sides and top, or more if the width of trench demands filling. The sides of the trenches will be used as the form for concrete. A careful selection of all pipe used is made so as to have the ducts straight and smooth. The conduit is laid with leveling instruments and the whole work very carefully inspected as it progresses. Some sections will be 600 feet or more in length and no difficulty has been experienced in other cities in drawing cables in ducts of this length when they are straight. Each section, as it is finished, will be cleaned out with flue scraper and wire brush, so that before the pavement is restored it will be known that every duct is available. This is all the more necessary in Indianapolis as the system for the most part will be laid in streets covered with asphaltum pavement laid upon concrete, which is very expensive. The manholes are the standard barrel-shaped pattern and vary in size according to the number of ducts. A cover of special design, which when raised serves to protect the opening to the manhole, will be adopted. It is anticipated that many difficulties will be encountered in laying the system inasmuch as there are pipes of several natural gas companies besides those of the regular gas company and water company and electric light conduits and sewers. Each section is planned out carefully before the ground is broken. Mr. E. M. Jackson is in charge of the system for the Central Union Telephone Company and under his able direction the work will be rapidly completed.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Sept. 2, 1896.

HIGH-SPEED ENGINES.—The representatives of the technical press go down to-day to the Loughborough works of the Brush Electrical Engineering Company to witness some trials of the enclosed high-speed engine designed by Mr. J. Raworth of that company. Great things are expected of this engine, and it may be anticipated that it will be a formidable competitor of the Willans engine.

ELECTRIC TRACTION AT PORTSMOUTH.—The special committee recently appointed by the Town Council of Portsmouth has recommended the municipality of that great naval port to purchase the undertaking of the local railway company for £60,000 and to equip the whole system electrically at a cost of about £90,000, and to subsequently relet the lines to the company at a remunerative rental, the municipality to supply the current to the railway company from its electric lighting station at 1½d. per unit.

MUNICIPALITIES AND THEIR ENGINEERS.—One of the natural consequences of the constant procession of our borough electrical engineers from one town to another, a procession which originates from the extremely low salaries still current, is that each engineer, as he comes into office, has a great desire to make a clean sweep of his predecessor's arrangements. In a few cases a clean sweep would be an unmitigated benefit, but in most it is an expensive luxury. Municipalities, however, are beginning to see the extreme costliness of low salaries, and, no doubt, this tendency to constant change of plant has been one of the conversion factors in the matter.

BOILER EXPLOSION.—A boiler explosion which was unhappily attended with the loss of one life recently took place at the Bankside station of the City of London Electric Lighting Company. The report of the Board of Trade on this explosion has now been published. No blame is attached to the officials of the company, and the only moral to be derived from the accident is the danger of relying upon boiler compositions, when the feed-water is highly laden with organic matter. The explosion was due to the choking of the back circulating tubes by a heavy deposit. The accident would probably have been prevented by the thorough cleaning of the boiler, but apparently the use of a boiler composition and blowing through were relied on to clear the pipes.

General News.

NEW INCORPORATIONS.

THE KITTANNING TELEPHONE COMPANY, Kittanning, Pa., has been granted a charter. Capital stock, $40,000.

THE NEW LONDON ELECTRIC LIGHT COMPANY, New London, Wis., has been incorporated with a capital stock of $15,000.

THE PIERRE DEVELOPMENT COMPANY, Spokane, Wash., capital stock, $100,000, has been incorporated by S. Cooper, J. A. Peacock and M. G. Denton.

THE GENEVA ELECTRIC LIGHTING WORKS, Geneva, Ill., has been organized with a capital of $10,000. The incorporators are C. M. Zuckner, J. H. Brown and B. O. Mayer.

THE MUTUAL ELECTRIC LIGHT COMPANY, San Antonio, Tex., has been formed with a capital stock of $50,000. Those interested are J. P. Greene, F. A. Piper and W. W. King.

MARQUETTE ELECTRIC COMPANY, Chicago, Ill., has been incorporated with a capital of $2500. The incorporators are Edwin O. Lamphere, Henry J. Brubaker and Ripley N. Baylis.

THE BALLINGER MANUFACTURING COMPANY, Ballinger, Tex., has been formed by C. H. Willingham, R. K. Wylie, J. A. Younger, T. D. Shider and H. C. Wylie, Ballinger, Tex. Capital stock, $10,000.

THE ELECTRIC RAILWAY CONSTRUCTION & MANUFACTURING COMPANY, Chicago, Ill., has been incorporated by John W. Jones, William Riley and Sterling P. Bailey. Capital stock, $250,000.

THE FRASER ELECTRIC ELEVATOR COMPANY, San Francisco, Cal., capital stock, $100,000, has been formed by E. M. Fraser, George Crocker, Charles E. Green, John J. Mahony, A. J. McNicoll, San Francisco, Cal.

THE ELECTRO-CHEMICAL STORAGE BATTERY COMPANY, Belleville, N. J. has been incorporated with a capital stock of $100,000. Those interested are Sigmund H. Rosenblatt, R. N. Chamberlain and A. S. Hubbard.

THE METROPOLITAN TELEPHONE & MESSENGER COMPANY, Tacoma, Wash., has been formed by R. T. Reid, G. F. Whitty, A. J. Hayward, George W. Bird, S. S. Loeb, Benj. Moyses and A. F. Eastman. Capital, $10,500.

TELEGRAPH AND TELEPHONE.

HERMAN, NEB.—The Nebraska Telephone Company has been granted the right of way by the Town Board to erect poles, etc., in this place.

GETTYSBURG, PA.—A telephone company has been organized in this place, and will make connections with York, Pa., in the near future.

TEMPERANCE, TENN.—There is talk of building a telephone line between this place and Alexandria and prominent citizens have the matter under consideration.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has just completed plans for a new exchange building on the West Side. It will be of steel, stone and brick and two stories above the ground. The cost of the new building will be $10,000 or $12,000.

ORANGE, N. J.—The New York & New Jersey Telephone Company has asked permission of the Committee on Roads and Assessments to lay conduits in order to place the company's wires underground in Park Avenue from the West Orange line to the East Orange line.

CHATTANOOGA, TENN.—Mayor Ochs has vetoed the ordinance passed at a recent meeting of the City Council granting a franchise to the Chattanooga Telephone Company. His objections are that franchises should not be granted in Chattanooga without adequate compensation, and under no circumstances in perpetuity.

PEKIN, ILL.—The telephone company has inaugurated a new system of charges for telephone service. It issues coupon books of $1, $5 and $10 the coupons being tendered in payment of the telephone tolls. The books reduce the cost of service as follows: Five dollars, 5 per cent.; $10, 7½ per cent.; $25, 10 per cent.; $50, 15 per cent.; $100, 25 per cent. The books are good for one year.

ELECTRIC LIGHT AND POWER.

MORENCI, MICH.—An electric light plant is to be installed in this place.

RANDOLPH, VT.—The question of introducing electric lights in this place is being considered.

ROME, GA.—A petition for a receiver for the Rome Electric Light Company has been filed. It is stated that the company failed to pay $790 interest on its bonds.

NEWARK, N. J.—Negotiations are almost completed for the absorption by the Newark Electric Light Company of the Excelsior Electric Light Company, of Harrison, N. J.

NEWBURYPORT, MASS.—A company, consisting of six business men, recently met to perfect and locate an electric plant, the object of which is to furnish shoe factories and stores, etc., with light.

NEW YORK, N. Y.—The electric light plant of the American Theatre was damaged by the recent storm, the current running along the wires to the dynamo. Gas had to be used in the theatre for the evening performance.

BRITT, IA.—The Britt Light & Power Company has been granted a franchise in this place and will begin active operations at once. The company is in the market for two 25-kw machines, engines, boilers, lamps, wire, etc.

VICTOR, COL.—The Victor Illuminating & Power Company is seeking a franchise for furnishing electric light and power to the City of Victor. The company will build a plant costing $30,000. The promoters of the enterprise are: F. A. Williams, P. H. Strong, R. G. Killen and Moses L. Stern.

BUFFALO, N. Y.—The Common Council of the City of Buffalo intends to cause a new electric plant to be installed at Police Headquarters, corner Seneca and Franklin Streets, and the Board of Public Works has been directed to prepare plans and specifications and advertise for sealed proposals for doing said work. Mark S. Hubbell, city clerk, can give further information.

MINNEAPOLIS, MINN.—During a fire here recently the Electric Light Company shut off the current, and a portion of the city was left in darkness. The Electric Light Company was assessed $106.25 for its inadequate light service on that night, but when it was shown that the company had shut off the current because of the consequent danger to life and property during the fire, the Council Committee on Gas cut the amount in two as a matter of equity, reducing it to $53.12.

The Electric Railway.

HACKENSACK, N. J.—The Union Traction Company has commenced to build a power house.

ROCHESTER, N. H.—An electric road connecting Rochester and East Rochester is proposed.

FAIRPORT, N. Y.—John Gunsaul is looking over the ground for a right of way for an electric railway in the village.

QUEBEC, QUE.—The Electric Railway Company proposes to commence the construction of the road at an early date.

SCRANTON, PA.—The traction company at Scranton is contemplating the erection of a new line of tracks around Hyde Park.

NEW YORK CITY—The Union Street Railway Company is preparing to extend its system by a line through Tremont Avenue from the Boston Road to Third Avenue.

IRVINGTON, N. J.—The Consolidated Traction Company will be asked to extend its Clinton Avenue line through Fabyan Place and up Cottage Street and Park Avenue.

SALT LAKE CITY, UTAH.—The Big Cottonwood Power Company has petitioned the Board of County Commissioners for permission to extend its lines to Murray and Sandy.

CHESTER, PA.—It is rumored here that the Pennsylvania Railroad Company will equip its two outside tracks between Chester and Philadelphia on the trolley system next Spring.

PATCHOGUE, L. I., N. Y.—The Patchogue & Port Jefferson Traction Company has presented its petition to the Patchogue Trustees for a franchise to build a road on Ocean and North Ocean Avenues.

ROCKVILLE, CONN.—It is understood that the Hartford, Manchester & Rockville Railway Company is ready to build the electric road as soon as the town gives them the right of way over the Burks Hill route.

WILMINGTON, DEL.—Work has been commenced on the Wilmington-New Castle Electric Railway, which will connect the two cities named. The company will also establish an electric light plant in New Castle, Del.

Legal Notes.

LYNCHBURG, VA.—Judge Simonton has entered a decree in the United States Circuit Court appointing Harry McDonald receiver of the Lynchburg Electric Company.

HARTFORD, CONN.—Judge McManus in the City Court on Sept. 5 dissolved the injunction issued against the Hartford Street Railway Company restraining the railway company from laying tracks on New Park and Newington Avenues.

COLUMBUS, O.—The Columbus Central Street Railway Company went into the hands of George H. Worthington, of Cleveland, as receiver on Sept. 5. The company is capitalized at $1,500,000 and is bonded for that amount. It has $175,000 in notes and open accounts, and $150,000 due to its president, John J. Shepard, of Cleveland, as liabilities. The action is taken at the instance of the bondholders, who are determined to save the property.

RECEIVER APPOINTED.—On Sept. 5, Justice Smyth, of the Supreme Court, appointed Arthur Sweeney receiver of the firm of Dale, Farrell & Co., electrical and mechanical engineers, at 413-415 East Twenty-third Street, New York. The proceedings were brought by Peter B. Sweeney, one of the partners, against John H. Dale and Philip Farrell, the other partners, for a dissolution of the firm. The assets are placed at $15,000, and the liabilities at $11,000.

FORT WAYNE, IND.—The Consolidated Street Railway was placed in the hands of receivers on Sept. 8, on motion of the president of the company. Mr. John G Shepherd, and Director F. De Hass Robison, of Cleveland. The N. J., Degnon Construction Company filed a lien of $85,000 against the property. Messrs. J. H. Bass and M. S. Robison, director and general manager respectively, were appointed receivers. The embarrassment, it is stated, is but temporary and the company will be able to pay its liabilities in full.

Obituary Notes.

JULIUS S. BIGGAR, who was well known in the West through his connection with the electrical business, died at Healdsbury, Cal., on July 28. His home was in Navarro, Cal. Mr. Biggar produced several electrical inventions of considerable merit. The cause of death was lung trouble.

ROBERT C. LAVERTY.—On Sept. 6, Robert C. Laverty, a well known and expert telegrapher and electrician, died at his home in West Philadelphia, Pa., at the age of 49 years. When he was 17 years of age he entered the service of the Government during the war as telegraph operator and was with Gen. Grant's command prior to the surrender of Richmond.

Personal Note.

MR. ELIAS E. RIES, formerly of Baltimore, Md., has removed to New York City, and has opened an office as consulting engineer and electrical expert at Room 1031, Temple Court. Mr. Ries is well and favorably known to the electrical profession as a scientific investigator and technical expert of no mean ability, and there is scarcely a line of practical electrical development in which he has not done original work. Mr. Ries is an active member of the American Institute of Electrical Engineers and other prominent societies, has been a frequent contributor to the electrical and engineering press, is a capable inventor, and has an extended practical experience which well qualifies him for his new field.

Trade and Industrial Notes.

ELECTRICAL APPARATUS IN ALASKA.—The C. & C. Electric Co., New York, has been awarded a contract for one 50-kw dynamo and one 50-hp motor, to be installed at Juneau, Alaska. This looks as if C. & C. apparatus will soon have a brushing acquaintance with the North Pole.

X-RAY OUTFITS.—The Columbian Manufacturing Company, Binghamton, N. Y., manufacturers of dynamos and motors, is placing on the market X-ray outfits, operated by high-frequency currents and Ruhmkorff coils. These outfits are meeting with great success, we are informed.

THE COLLIERY ENGINEER COMPANY.—The offices of the Colliery Engineer Company, proprietor of the International Correspondence Schools, Scranton, Pa., were partially destroyed by fire on Aug. 30. Fortunately the fire did not cause any interruption to the business, and the work of enrolling and instructing students in the various schools is proceeding as before. The company has secured quarters in the new Mears Building, and its new offices are more convenient and commodious than the old. The company is erecting a new building of its own which will be occupied upon completion. All the records of students and the important files were in safes and were consequently preserved from destruction.

THE "PIONEER" LAMP.—Improvements in the processes of fire extinguishing are very important in assisting to save life and property, but methods of fire prevention will naturally have precedence. Great fires have frequently been started by the sparks dropping from open arc-lights. The new improvement of enclosing the arc, in addition to its many other advantages, guarantee safety from this danger. The "Pioneer" enclosed arc-lamp, manufactured by the Electric Arc Light Company, is claimed to be a sure preventive of fire from the former weakness of the arc. All fire insurance people, it is said, welcome the introduction of the "Pioneer" as eliminating the fire risk from this source. The enclosing bulb is a simple and most effective safeguard.

MESSRS. BURHORN & GRANGER, 136 Liberty Street, New York, agents for the "Woodbury" engine, are installing 9 x 12 direct-connected engines at the Merritt apartment house, in Eighty-first Street, and for the Safety Insulated Wire & Cable Company; also one at Schneider's Building, Union Hill, N. J. In addition they report the following recent installations: One 9 x 12 inches, direct-connected to Ft. Wayne generator, for the the D. Jones Brewing Company, Forty-fourth Street and First Avenue, this being the combination which attracted such favorable notice at the recent Electrical Exhibition; one 12 x 14 inches and one 9 x 12 inches, direct-connected, at the new Hotel Mathewson, Narragansett Pier, R. I.; one at the Highland Spring Brewery, Boston; one for G. W. Angier & Co., Boston; one for the Old Colony Brewing Company, Fall River, Mass.; one for the Western Electric Company, Chicago; two for the Irondequoit Park Railway, Rochester, N. Y., and a large consignment for the Osaka Electric Light Company, Osaka, Japan, including three 8 x 12 inches, one 9 x 12 inches, one 14 x 18 inches, one 9¼ x 14 inches, one 14 x 14 inches, tandem compound, and three 13½ x 23 x 16 inches tandem compounds. Both the machine and the boiler shops of the Stearns Manufacturing Company, Erie, Pa., the builders of the Woodbury engines, are well filled with work on hand.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York.

HARVEST EXCURSIONS.—In order to give every one an opportunity to see the grand crops in the Western States and enable the intending settler to secure a home, the Chicago, Milwaukee & St. Paul Railway has arranged to run a series of harvest excursions to South and North Dakota, and to other States in the West, Northwest and Southwest on the following dates: July 21, Aug. 4 and 18, Sept. 1, 15, 29 and Oct. 6 and 20, at the low rate of $2 more than ONE FARE for the round trip. Tickets will be good for return on any Tuesday or Friday within 21 days from date of sale. For rates, time of trains and further details apply to any coupon ticket agent in the East or South, or address E. F. Richardson, General Agent Pass. Dept., 381 Broadway, New York. (9-19)

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 8, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

566,939. ELECTRIC CAR BRAKE; A. B. Roney, Chicago, Ill. App. filed April 2, 1895. In an electric car brake, the combination with a motor, a screw-threaded shaft driven thereby, and a yielding connection between said shaft and the armature of the motor, of a nut working on said shaft and held against rotation, and a brake rod connected with and actuated by said nut.

567,132. TELEPHONE TRANSMITTER; R. P. Green, Columbus, O. App. filed May 31, 1895. In a telephone transmitter, the combination of a main diaphragm, a conducting pin secured to and projecting from said main diaphragm, an inner or secondary diaphragm consisting of two conducting plates, the inner faces of said plates being separated by a frame of non-conducting material, a filling of granular conducting substance between said plates, a wire leading from the secondary diaphragm, and a wire leading from the main diaphragm.

567,133. TROLLEY WIRE CROSSING; H. M. Handshy, San Antonio, Tex. App. filed March 19, 1896. In a trolley wire crossing, the combination with pivotally-connected crossed conducting-arms, each of said arms having triangular end portions, and a bar connecting said end portions, openings in said bar, an insulating plate between said bars, and openings in said plate adjacent to its periphery, each of said bars being adapted to support a trolley wire longitudinally thereon.

567,137. AUTOMATIC CIRCUIT-BREAKER; E. M. Hewlett, Schenectady, N. Y. App. filed April 17, 1896. In an automatic circuit-breaker, the combination of a blow-out magnet, a core for the magnet, a U-shaped piece extending parallel to the core and separated therefrom, a plate forming a support for the U-shaped piece, a second plate of magnetic material secured to the core of the magnet, and switch contacts between the plates.

567,156. ELECTRIC LOCK; W. S. Nash, Knoxville, Tenn. App. filed Nov. 21, 1895. In a door lock, the combination of a latch bar or bolt, a head portion and a neck portion of the said latch bar or bolt, and laterally projecting shoulders at one end of said latch-bar, and lateral projections at the other end of the same, a lock-bar provided with a recess adapted to receive the neck portion of the latch bar so that it may slide therein, and lateral projections at one end of said lock-bar, adapted to engage and interlock with the laterally projecting shoulders of the latch bar and lateral projections at the other end of the said lock-bar, an outer knob-tumbler engaging with the said lateral projections of the lock-bar, an inner knob-tumbler acting independently of said outer knob-tumbler and engaging the lateral projections on the latch bar, and means for locking and unlocking the lock-bar.

567,170. TELEPHONE SWITCH; D. Rousseau, New York, N. Y. App. filed March 18, 1895. In a telephone switch, the combination with a switch arm and means tending to maintain the same in its normal position, of a detent lever for locking the switch arm at various points of adjustment, means controlled by the hanging of the telephone on its hook, for moving the detent lever a sufficient distance from its locking position, and a retarding device for retarding the movement of the detent lever toward its locking position whereby the switch arm will be free to return to its normal position.

567,176. CONTACT DEVICE FOR ELECTRIC BURGLAR ALARMS; P. Unger, Lemont, Ill. App. filed June 22, 1896. A contact for burglar alarms comprising an insulating plate, binding screws, a base plate struck up from sheet metal, with pivot lugs secured thereto, and a contact lever, also made of sheet metal, having its operating end bent under to provide a spring connection integral and adapted to connect the binding screws of an alarm circuit.

567,186. TROLLEY WIRE AND TROLLEY WHEEL; P. Cassidy, Worcester, Mass. App. filed May 8, 1896. As an article of manufacture, a trolley wire comprising a substantially cylindrical rib or bead, and a tapering, substantially V-shaped body portion for engaging the trolley wheel, the rib and body portions of the wire being separated by substantially V-shaped grooves arranged to engage supporting clips or fasteners.

567,197. CONSTANT-POTENTIAL ALTERNATING GENERATOR; E. W. Rice, Jr., Schenectady, N. Y. App. filed May 15, 1896. In combination, an alternating-current dynamo-electric machine, a transformer having a primary coil in shunt to the mains, a secondary, and a modifying magnetic shunt, and a rotary converter connected upon its alternating-current side to the transformer secondary and upon its other side to the field magnets of the alternator.

567,211. ELECTRICAL TRAIN-SIGNALING DEVICE; J. E. Young and E. S. Norton, Conneaut, O. App. filed May 11, 1896. In a train signaling apparatus, the combination of an electric signaling device at one end of the train, insulated conductor wires enclosed within the air pipes extending from car to car and separated at every air-cock in the air pipes, with the air pipes, the air-cocks therein, and switches operated by said air-cocks, and wholly enclosed within said air pipes, for closing the breaks in said conductor wires

567,223. RHEOSTAT; W. W. Dean, St. Louis, Mo. App. filed March 28, 1896. In a rheostat, the combination with a non-combustible core, of a resistance wire wound thereon, a flexible, non-combustible envelope surrounding said core and resistance-wire, two metallic supports adapted to secure said rheostat in position, said supports constituting the terminals of a circuit, and means for electrically connecting the terminals of said resistance-wire with said supports.

567,227. ELECTRIC ARC LAMP; E. F. G. H. Faure and J. MacHaffie, Schenectady, N. Y. App. filed March 20, 1896. The combination in a focusing arc lamp, of a plurality of feed-screws having the same pitch, gearing to vary the rate of feed between the screws, and means for moving one screw longitudinally with respect to the other.

567,237. ELECTRICAL TRANSFORMER; H. M. Hobart, Boston, Mass. App filed May 15, 1896. In a transformer, a built-up core having its sides and ends composed of bundles of laminæ of magnetizable material united at their ends, said bundles of laminæ being assembled in offset relation lengthwise and laterally to form ventilating and circulating spaces between the coils and the core, and between the passages of the core.

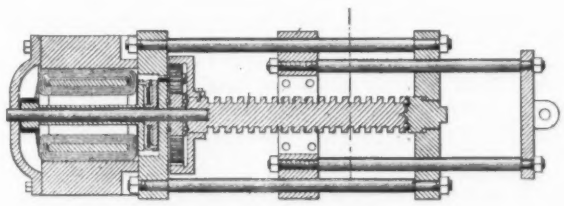
567,247. ELECTRIC HEATER; J. E. Meek, New York, N. Y. App. filed Jan. 7, 1896. An electric car-heater which consists of the combination of a woven fabric of asbestos, or similar incombustible and insulating fibre, with an electric conductor embedded in the woof of said fabric and a backing of incombustible millboard to which said fabric is attached, said fabric having a proper quantity of "size" or other material for stiffening applied thereto.

567,248. ELECTRIC HEATER; J. E. Meek, New York, N. Y. App. filed Jan. 7, 1896. An electric car-heater which consists of a woven fabric of asbestos, or similar incombustible or insulating fibre, with an electric conductor embedded in the woof of the fabric, the said fabric being folded upon itself one or more times and having a proper quantity of "size" or other stiffening material applied thereto.

567,250. ELECTRICAL TRANSFORMER; W. S. Moody, Lynn, Mass. App. filed March 30, 1896. A transformer consisting of a built-up core, having its sides composed of bundles of metallic laminæ with overlapping ends, and its ends composed of bundles of metallic laminæ breaking joint with the sides, shellaced fibre paper wrapped around the side laminæ, insulating pins securing the latter together, and windings about the sides of the core.

567,257. ELECTRIC RAIL-BOND; G. H Scott, Worcester, Mass. App. filed March 9, 1896. An improved electric rail-bond, comprising in combination a connecting-rod or wire and two collars, one for each end of said rod or wire, adapted to fit over the ends thereof and in the openings in the rails, and made cylindrical in shape, also provided with an external annular rib or flange at its inner end, and an internal annular bevel at its outer end flaring outward from its longitudinal opening and also preferably having the exterior of its outer end beveled in the opposite direction to said internal bevel.

567,306. ELECTRIC RAILWAY TROLLEY; R. N. Dyer, East Orange, N. J. App. filed April 30, 1896. In electric railways, the combination with an upward pressure trolley, of an electrically operated device for producing and maintaining the necessary contact between the trolley and the working conductor, such electrically operated device being independent of the operation and regulation of the car motors.



No. 566,939.—ELECTRIC CAR BRAKE.

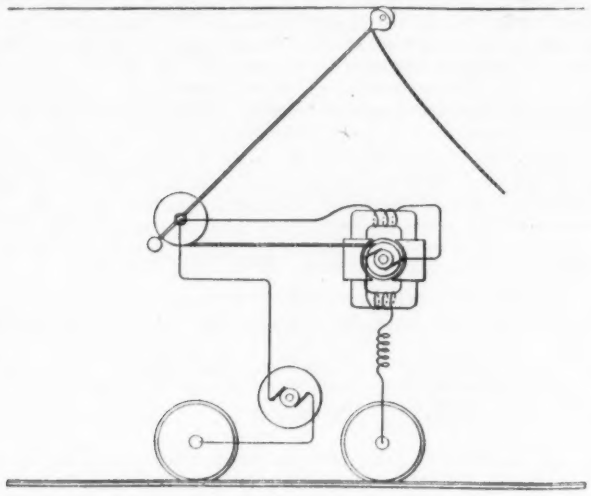
567,307. ELECTRIC RAILWAY TROLLEY; R. N. Dyer, East Orange, N J. App. filed April 30, 1896. In electric railways, the combination with an upward pressure trolley, of an electrodynamic motor connected with the trolley and acting to lift the same with the torque or pull, which is constant and uniform throughout the entire range of adjustment of the trolley.

567,322. SAFETY DEVICE FOR HANGING ELECTRIC ARC LAMPS; E. P. Snowden, St. Joseph, Mo. App filed Jan. 23, 1896. In a safety device for hanging electric arc lamps, the combination of springs together with conductors for closing the circuit through the lamp and breaking the circuit in hanger by a conductor first passing between and above the springs together with a table and cables.

567,324 TELEPHONE TRANSMITTER; A. Stromberg and A. Carlson, Chicago, Ill. App. filed Oct. 29, 1895. In a telephone transmitter, the combination with the main diaphragm of the auxiliary diaphragm situated in front of the main diaphragm, and composed of material which is not affected by moisture, the edges of said auxiliary diaphragm being firmly clamped to prevent the entrance of moisture or water around the edges of the diaphragm, an air space being left between said diaphragms whereby the transmitter is rendered moisture-proof and the transmission is facilitated by the air-space.

567,325. TELAUTOGRAPH; G. S. Tiffany, Highland Park, Ill. App. filed June 7, 1895. In a telautograph system, the combination of a line wire or wires, means for sending pulsations to the line for operating the receiving pen, a charging generator and a switch for throwing the same into line at one station and a battery and magnetically-controlled automatic switch in the main-line circuit at the distant station, the automatic switch being irresponsive to the normal working pulsations on the line, but being operated by the current from the charging generator so as to throw said battery into the charging circuit.

567,338. ELECTRIC SIGNAL LAMP; J. R. Farmer, St. Louis, Mo. App. filed March 14, 1895. In an automatic signal for electric railway crossings, the combination of the crossing trolley wires, having adjacent thereto contacts to be charged by impingement of the trolley, a movable signal lamp, an armature controlling the movement of said lamp, electromagnets moving said armature in opposite directions, a conductor leading to ground, conductors leading from the trolley contacts to contacts at opposite ends of the armature, brushes carried by the armature and adapted to impinge on their respective contacts by opposite movements of the armature, conductors connecting the respective brushes with corresponding magnets, and wires connecting both magnets with the common ground connection through the lamp so that when either trolley contact and trolley wire are bridged by a trolley wheel, the contact, the corresponding magnet and the lamp are connected in a series-circuit branched from the main line and independent of the motor and the connection from the other track is mechanically interrupted.



No. 567,307.—Electric Railway Trolley.

567,355. ARC LAMP CLUTCH; H. R. Palmer, Norfolk, Va. App. filed June 10, 1896. A carbon-feed rod, a clutch plate having an orifice and an integral arm, a hook secured to the outer end of said integral arm, a pitman pivotally engaging said hook and adjustably secured on the regulator rod.

567,366. GOVERNOR FOR REGULATING SPEED OF MACHINERY; E. Thunderbolt, Carlton, Victoria. App. filed July 10, 1896. In governors for regulating the speed of machinery, the combination of an electromagnet adjustably secured to a lever having a sliding fulcrum-standard with a piston rod adjustably secured to such lever and carrying a piston which operates to open and close ports in a cylinder, such cylinder having an outer casing with inlet and outlet pipes.

567,381. MAGNETIC SEPARATOR; R. Eickemeyer, Yonkers, N. Y. App. filed Jan. 10, 1890. The combination of a rotative drum provided with longitudinal separating bars or iron, and an interior stationary electro magnet, having a series of ribs or cores, segmental in form and each enclosed longitudinally by its own winding or field-coil.

567,382. MAGNETIC SEPARATOR; R. Eickemeyer, Yonkers, N. Y. App. filed Jan. 28, 1890. In a magnetic separator, the combination of a rotative separating drum, provided with longitudinal separating bars, and two internal magnetic stationary magnetic systems, one of which oppositely polarizes each bar intermittingly while moving through a portion of its circular path, and the other causes alternating bars to be oppositely polarized while moving through another portion of said path.

567,404. APPARATUS FOR TELEPHONE SWITCHBOARDS; F. R. McBerty, Downer's Grove, Ill. App. filed Jan. 24, 1896. The combination with an annunciator board in which are located the annunciators and terminal sockets of a number of telephone lines, answering-boards in each of which are located terminal spring-jacks of said lines, and trunk-lines from the annunciator-board to the different answering-boards, of a signal at the annunciator-board for each answering-board, and means for exciting each of said signals, controlled at the corresponding answering-board.

567,411. TROLLEY; E D. Priest, Schenectady, N. Y. App. filed May 13, 1896. In an electric railway, the combination of a vehicle, an overhead conductor, a contact device carried thereby, a lazy-tongs connection between the contact device and the vehicle, gears mounted on the base and secured to the lazy-tongs, and intermediate gears for imparting corresponding movements to the arms.

567,416. INSULATED RAIL JOINT; R. C. Scofield, Boonton, and J. Wayland, Newark, N. J. App. filed July 22, 1896. A rail-bond comprising insulating coupling-blocks at the sides of the rails and a bed-plate for the rail ends having an upwardly-extending rib on one side only.

567,422. GALVANIC RING; M. L. Thompson, Brooklyn, N. Y. App. filed June 29, 1896. A galvanic ring for remedial purposes composed of sheet metal of different polarity, the edges of the outer strip being folded over the edges of the inner strip to hold the same and to present a substantially equal surface for the action thereon of the moisture from the body.

567,423. DYNAMOELECTRIC MACHINE; R. Thury, Geneva, Switzerland. App. filed Aug. 5, 1895. In a dynamo-electric machine, a circular magnet having an annular cavity and a helix therein and an annular side opening whose opposite surfaces constitute the N and S poles, an armature ring within the annular side opening between the N and S poles, a shaft therefor and means for rotating said armature, the armature and one pole-piece consisting respectively of teeth-like projections and laminated rings with a flat surface winding directly upon the edge face of the laminated rings.

567,424. TRANSFORMER FOR ELECTRIC CURRENTS; R. Thury, Geneva, Switzerland. App. filed Feb. 3, 1896. A machine for transforming a current of a constant number of amperes into a current of a constant number of volts or inverse characterized by a single inductor, a single armature bearing, on the one hand a motor winding (primary coil) of the system Pacinotti, and on the other hand a generator winding (secondary coil) of the drum system, a magnetic shield being interposed between the two coils of the armature, and a regulator being provided for controlling the position of the primary brushes and volts absorbed by the primary coil according to the watts produced in the secondary coil.

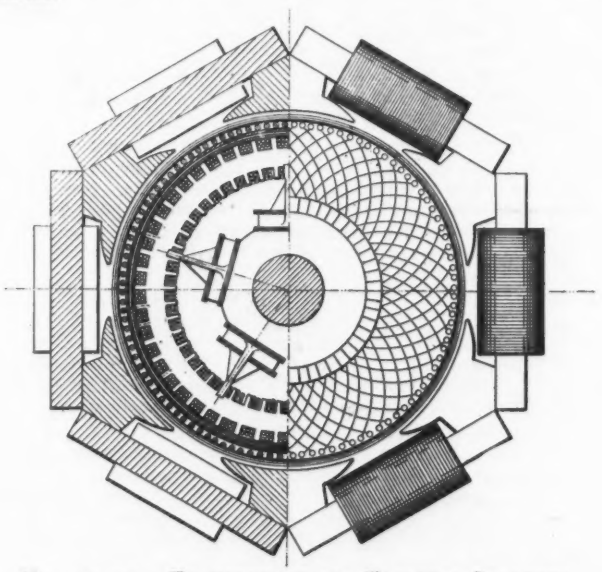
567,474. TROLLEY FOR ELECTRIC CARS; J. E. Hewes, Philadelphia, Pa. App. filed May 7, 1896. The combination in a trolley of a pivoted pole carrying the contact at the free end, a main spring for normally pressing the pole upward, an auxiliary spring acting directly upon the pole at a distance from its pivot adapted to pull the trolley pole down against the action of the main spring, a connection between the primary spring and trolley pole at a distance from its pivot whereby the said spring acts upon the pole with great leverage, a latch for holding the auxiliary spring out of action, a latch-releasing device connected to the pole between its pivot and contact and adapted to be actuated when the pole attempts to assume a vertical position, and a common support for the two springs.

567,487. CAR STORAGE ARRANGEMENT; E. F. Mann, Detroit, Mich. App. filed Nov. 20, 1895. In combination with a building for storing trolley cars having therein a track and trolley wire extending above said track, a break in said trolley wire near the entrance to said building, and a switch located outside of said building to throw said trolley wire in and out of circuit.

567,514. ADVERTISING DEVICE; F. A. Ruge, Springfield, N. Y. App. filed May 22, 1896. An advertising device, comprising a source of electricity, a number of incandescent lamps having connection therewith, resilient contact-fingers insulated one from another, each contact finger having electrical connection with a lamp, a contact-plate common to all the fingers and having connection with the source of electricity, uprights, a rotary shaft at the upper ends of said uprights, a rotary shaft at the lower portion of said uprights, sprocket wheels on each shaft, sprocket chains operated by said wheels, transverse bars having their ends secured to the block portions of the chains, and lugs variously arranged on the bars for forcing the contact-fingers into engagement with the contact-plate.

567,517. ELECTRIC RAILWAY; C. Sill, New York, N. Y. App. filed Nov. 1, 1895 An electric railway comprising switches provided with insulation, consisting of tubes, and alternate layers of cement, the said layers and tubes one arranged within the other.

567,531. HOLDER FOR ELECTRIC LAMPS; W. S. Arnold, San Francisco, Cal. App. filed March 17, 1896. A flexible support, the core or body portion of which comprises a number of ductile wires twisted together and having the conducting wires twisted and laid in the recesses between the wires forming the core, and having strengthening wires also lying in said recesses.



No. 567,424.—Transformer for Electric Currents.

567,540. ELECTRIC RAILWAY; W. F. Grassley, Williamsport, Pa. App. filed May 8, 1896. In an electric railway, the combination with a surface truck, of a third conductor rail arranged adjacent to and at one side of one of the track rails, a motor-car truck having one of its wheels provided with separate treads insulated from each other and respectively traveling on one of the track-rails and said third rail, and a collecting device for the motor of the car-truck.

567,550. SWING FOR ELECTRIC LIGHT OR TELEPHONE BRACKETS; A. Petereit, New York, N. Y. App. filed Nov. 15, 1895. As an improvement in swings for electric lights and telephones, a joint, consisting of a slotted hollow main section or socket, in combination with a removable section adapted to be supported in the first section, one of said sections provided with a shoulder forming a bearing surface for supporting the second section vertically, and a compressor for compressing the slotted nipple around and upon the section which is secured within the lower section.